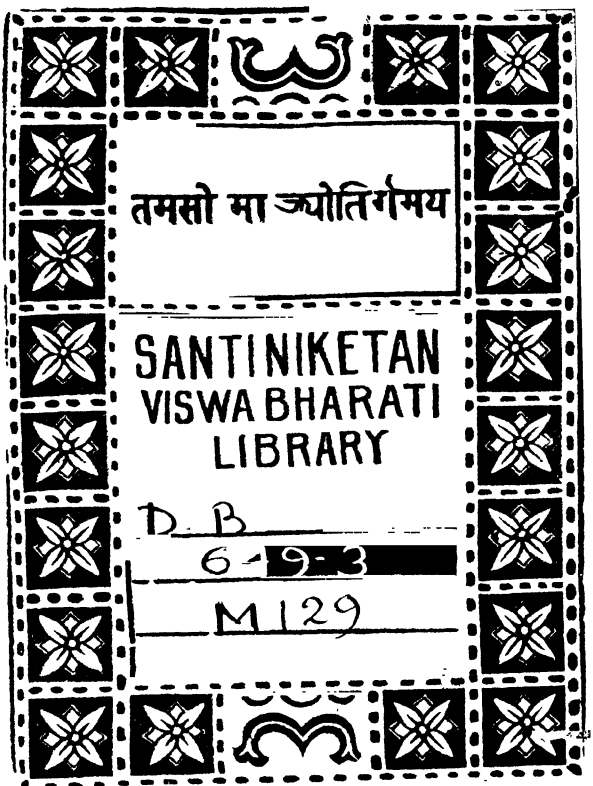
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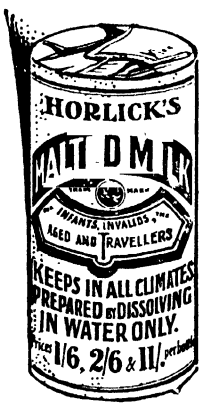

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Milk Sugar	5·04
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Cellulose	0·18
Mineral Matters	3·80
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AIDS

TO THE

FEEDING AND HYGIENE OF INFANTS AND CHILDREN

BY

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PREFACE

THE subject of the Feeding of Infants and Young Children, whether at the breast or by artificial methods, is one of the first importance. The following pages are an attempt to deal with it in a way which, it is confidently hoped, will prove helpful to senior students and busy practitioners whose time for reading and sifting elaborate treatises is limited. Free use has been made of the writings of such well-known workers in this field as Rotch, Cautley, Hutchison, Holt, Cheadle, and Eustace Smith, and to these the author expresses his sense of great indebtedness.

A word of thanks is due to the Publishers for their kind help at this as well as at all other times.

JOHN McCAW.

74, DUBLIN ROAD,
BELFAST,
July, 1903.

CONTENTS

CHAPTER I

CHAPTER II

CHAPTER III

CHAPTER IV

CHAPTER V

CHAPTER VI

CHAPTER VII

CHAPTER VIII

AIDS TO INFANT FEEDING

CHAPTER I

PHYSIOLOGY OF THE DIGESTIVE SYSTEM IN INFANCY AND CHILDHOOD

The salivary glands: Condition at birth—The amylolytic function—Ptyalin—When their function is established. The stomach: Size at birth—Development of the gastric juice—Its action on milk—Nature of the coagulum formed by milk—Duration of gastric digestion. The intestines: Characteristics of in infancy—The intestinal juice—Intestinal digestion. The pancreas: The pancreatic juice—Its action, and when developed.

THE following short statement regarding the condition of the digestive organs at birth, and their development during the first year of life, may be found useful, and help to a better understanding of the subject of infant feeding.

The Salivary Glands.—The secretion from these glands is very scanty at birth, and as a consequence the mucous membrane of the mouth is comparatively dry and of a whitish colour. It is not until the third or fourth month that the saliva flows freely and the child begins to dribble. The amylolytic function, or the power of converting starch into sugar, is very feebly present in the secretion at birth; but by the third or fourth month it shows distinct evidence of the presence of ptyalin, and readily converts cooked starch into maltose. This function is not fully established until the end of the first year.

The activity of the salivary secretion is continued in the stomach for half an hour or so, until it is stopped by the action of the hydrochloric acid.

The Stomach.—This organ is very small at birth, its capacity being about 1 fluid ounce. It increases rapidly in size, so that by the end of the first month it will contain 3, and at the sixth month 6, ounces of fluid. Its position is nearly vertical, the fundus being but slightly developed. Owing to the weakness of its muscular layers, regurgitation of food and accumulation of gases readily take place, and for the same reason dilatation may be easily induced. The gastric juice contains both hydrochloric acid and pepsin in the infant, but gastric digestion is at this early date only a partial one, the stomach acting more the function of a reservoir, from which the food is passed on into the intestine. The acid of the gastric juice is very completely taken up by the proteids of milk, and it is only after an interval of an hour or so, and when the stomach has passed on its contents into the intestine that the presence of free acid can be demonstrated. When milk is taken into the stomach, it becomes coagulated in from ten to fifteen minutes, by the action of a ferment called rennin. Part of the coagulum is acted upon by the pepsin and the hydrochloric acid, and becomes converted into soluble peptones, while the remaining part is passed on into the intestine, where proteid digestion is continued in an alkaline medium. The coagulum formed in the stomach varies very much with the kind of milk, the curd of human milk being in the form of fine flocculi, while cow's or goat's milk gives rise to dense, tough masses, especially when it is taken undiluted. Gastric digestion lasts about one hour, when the infant is breast-fed, and about half an hour or so longer, when cow's milk is given.

The Intestines are characterized by their great mobility, the cæcum and sigmoid flexure being especially free. It has been said already that the proteids are only partially digested in the stomach; it is in the intestines that the greater part of digestion and absorption is carried out. The intestinal juice is alkaline in reaction, and consequently it is of assistance in the emulsification of fats and in tryptic digestion. The conversion of starch into

sugar is but feebly carried on for the first few months of life, but after this time the diastatic function becomes vigorous.

The Pancreas.—The pancreatic juice contains trypsin even at birth, and assists in the emulsification of fats. It has little amylolytic power for the first few months of life, and is therefore able to exert but a feeble effect upon starch; nor does it acquire this power to any extent until after the sixth month.

CHAPTER II

INFANT FEEDING

Constituents of the food—Proteids—Fats—Sugar—Salts—Water.

Constituents of the Food.—The food chosen for the nourishment of the infant must be of such a character as to be assimilable by the digestive organs at this period of life, and it should be remembered that the child not only requires that which will provide for the general nutrition of its body, but also, and in addition, a supply of food that will enable it to grow and develop. **What, therefore, are the essential elements of such a food? They are as follows:**

Proteids.—These are necessary in considerable amount, as they enter into the structure of every cell and assist in the formation of the tissues of the body. For these reasons they are more abundantly required by the child than by the adult. An adult weighing 10 stone 7 pounds requires about 100 grammes of proteid daily, while an infant weighing 13 pounds takes 20 grammes of proteid in its milk daily, a much larger proportion to its weight than the adult. The proteids of milk are the casein and the lact-albumin. Other proteids are the myosin of meat, egg-albumin, and certain vegetable forms, such as the gluten of wheat and vegetable myosin. Should the proteids be deficient in the food supplied to the child for any length of time, very marked consequences follow. It becomes anæmic and bloodless; it is languid, and the signs of general malnutrition—such as want of growth, with soft and flabby muscles—speedily follow. On the other hand, the opposite error of giving too much proteid

should be guarded against, in view of the limited capability of the child to digest it. When the proteids are in excess in the food, the child suffers from constipation, colic, and indigestion.

Glycerides, or Fats.—The food of the infant should be rich in fats. Fats enter largely into the construction of the bones, the nerve cells, and the fibres, and a deficiency of them in the diet is generally held to be a potent cause of rickets. Little less important than their nutritive qualities is their power of maintaining the bodily heat by combustion, and to this end they are stored up in the body to be called upon should occasion require. The fats taken in the food are very completely absorbed, and it is only occasionally that they can be found in the fæces of infants. An infant will, in proportion to its weight, take three times as much fat in its food as an adult, and this is necessary if its bodily temperature is to be maintained, because the infant has not the power of heat production, by means of muscular exercise, which is possessed by the adult. Fats have a natural laxative effect, too, which is most important, and an extra quantity of them may be made use of for the purpose of counteracting constipation. Should the fats be deficient in the food, general malnutrition results, and constipation and colic are engendered. Should they, on the other hand, be excessive, vomiting and diarrhœa supervene, and much fat is passed in the stools.

Carbohydrates, or Sugars.—These have a high value as heat-producers, and as a source of muscular energy. They are partly converted into fat in the economy. The percentage of sugar in human milk varies very little, as the following table shows. It is the result of a large number of analyses made by Leeds :

TABLE I.

Carbohydrates.

Maximum	...	...	7·92 per cent.
Minimum	...	...	5·40 „

Lactose is the only form of carbohydrate found in milk. It is very soluble and easily absorbed, being converted into glucose. When the amount of sugar in the food is

excessive, the child becomes very fat and flabby ; it is also, as a rule, pale and pasty-looking or anæmic, and does not show that degree of energy which one is accustomed to see in healthy children. Such children frequently develop rickets, and they certainly show poor powers of resistance when attacked by acute disease. A very common result of an excessive quantity of carbohydrate in the food is acid fermentation, followed by flatulent colic and the passage of sour-smelling and curdy motions, which are often offensive.

Salts.—Mineral salts are very important elements for the proper formation of the bony structures, as well as for cell growth. The most important of these are the salts of potash, lime, and sodium. Phosphorus is highly important in the formation of bone, and is present in all milks. Iron is present in milk in small quantity, about 0·003 per cent. of the dry solids.

Water.—This is essential to life, and constitutes three-fourths of the body-weight. Because of its greater metabolic activity, the young child requires more of it than the adult, in proportion to its weight. Water is also necessary for the solution of the elements of the food.

In addition to these essential constituents, an infant's food must possess the antiscorbutic element. It is not clear what this property consists of, but it is known to be present in fresh milk, and it is especially abundant in fresh vegetables. This element is absent in the various forms of condensed milks and proprietary foods, and it is rendered inert in milk by prolonged boiling.

Having now before us the essential elements of the food required by the infant for its growth and development, we may proceed to consider how these are to be given in combination under the heads of—(1) Natural Feeding, or that provided by Nature in the secretion of the breasts ; and (2) Artificial Feeding.

CHAPTER III

NATURAL OR BREAST FEEDING

Natural or breast feeding—Its importance—Human milk—Its characteristics—Colostrum—Its composition—Chemical composition of human milk Variations in fat and proteid—How to estimate the proteids—The proteids—The fats—Carbohydrates—Salts—Presence of bacteria—Quantity of milk secreted—How to estimate the amount—Variations in quantity—Conditions affecting the secretion.

It is universally admitted by medical writers in all countries that by far the most satisfactory method of rearing an infant is that of breast feeding. It follows, therefore, that every infant should be breast-fed when this is at all possible ; and, on the principle that half a loaf is better than no bread, in those cases where the secretion is scanty it should get what there is to be had. Human milk, then, being the standard, it is of the utmost importance that a clear knowledge of its characters and composition be acquired, should it become necessary to substitute for it an artificial food.

Human Milk.

Human milk is a bluish-white, watery fluid, sweet to the taste and alkaline in reaction. The specific gravity varies between 1·030 and 1·035, and is generally about 1·031.

An excess of proteids or of sugar raises the specific gravity, while an excess of fat lowers it. Examined under the microscope, the milk will be seen to consist of two parts—the fat globules, and a clear fluid, or plasma, in which is some granular matter, and occasionally some

epithelial cells from the ducts of the breasts. The fat globules are of fairly uniform size, and vary between 0·00015 to 0·005 millimetre in diameter. They are larger in human than in cow's milk, and are most numerous in the secretion of young, healthy, and well-nourished women. Milk being a perfect emulsion, the fat globules do not run together, but remain in suspension, and when it is allowed to stand for some hours, they rise to the surface in the well-known form of cream.

The milk secreted by the breasts during the first week after the birth of the child is called **colostrum.** It differs materially from the normal standard, and possesses some peculiar characters. It is more watery-looking, is yellow in colour, strongly alkaline, and coagulates on boiling, or in some cases spontaneously, into large masses. The specific gravity is high—from 1·040 to 1·046—and the amount of proteid present is much greater than in ordinary milk, being generally about 5 or 6 per cent. The fats and the carbohydrates are low in amount, while the salts are excessive. The following table shows its approximate composition :

TABLE II.

Colostrum.

Proteids	5·71
Fat	2·04
Carbohydrate	3·74
Salts	0·28
Water	88·23

When examined microscopically, certain bodies are seen which are of the nature of degenerated epithelial cells—**the colostrum corpuscles**—and which give to the fluid its yellow colour. They vary much in number and size and contain fat globules. Colostrum corpuscles are present in the milk for one week after parturition, but illnesses of any kind, such as puerperal affections, retard their disappearance, or may bring about their reappearance. Colostrum is generally supposed to have a laxative effect upon the infant, thereby hastening the expulsion of the meconium.

Chemical Composition.—To obtain a sample of human milk for analysis a breast-exhauster is used, and scrupulous cleanliness exercised. The nipples and breasts are washed with soap and water, after which they are sponged with hot solution of boracic acid, and the breast-exhauster is previously sterilized. The best sample for examination is the milk taken from the middle period of the nursing, as this represents the most correct average. Having obtained the quantity required, the analysis is proceeded with, and the method adopted by **Dr. Holt, of New York**, may be employed as giving a fairly accurate estimate of the percentages of the constituents. His results are based upon the examination of a large number of specimens of human milk, and upon the following well-known chemical facts :

1. That the specific gravity of human milk varies between 1·029 and 1·032, the average being 1·031 at 70° F. Abnormal variations occur between the limits of 1·017 and 1·036. An increase in the fats lowers the specific gravity ; an increase in the other solids raises it.

2. That the salts do not vary much in their amount in human milk. They are too insignificant in percentage to affect the specific gravity, and in the chemical examination of milk they need not be considered.

3. That the proportion of the sugar is nearly constant in human milk under all circumstances. This point has been emphasized by all the chemists who have made milk analyses.

4. That in striking contrast to this uniformity in the sugar are the wide variations met with in the fat and the proteids, as is shown by the following tables :

TABLE III.

Variations in Fat in Human Milk (Rotch).

From 48 analyses	by Leeds ...	2·11 to 6·80 per cent.
„ — „	by König ...	1·71 to 7·60 „
„ 29 „	by Chem. Lab. Coll. Phys. and Surg., New York	1·12 to 5·02 „

TABLE IV.

Variations in Proteids in Human Milk (Rotch).

From 43 analyses	by Leeds	...	0·85 to 4·86 per cent.
„ — „	by König	...	0·57 to 4·25 „
„ 29 „	by Chem. Lab. Coll. Phys. and Surg., New York	...	1·10 to 3·62 „

5. That to determine the composition of milk we must have a knowledge of the proportions in which the two elements which vary most widely—namely, the proteids and the fat—are present.

6. That from the fact that the proportion of sugar is so nearly constant, and that the salts are in such small amount, we may, for clinical purposes, consider the specific gravity as modified solely by the fat and the proteids.

7. That there is no known method of determining directly the percentage of proteids by a clinical examination, and that a complete chemical analysis by an expert is the only one that can be accepted as accurate.

Examination of Milk by Holt's Method.—The instruments required are a small hydrometer, a pipette, and a glass-stoppered cylinder graduated in 100 parts, and capable of holding about 10 c.c. Either the whole nursing or about 15 c.c. (½ ounce) of the middle milk should be used, and it should be handled as little as possible, especially if the weather is warm at the time. The specific gravity is taken by the hydrometer. The percentage of fat is determined by estimating the percentage of cream as follows: The glass-stoppered cylinder is filled with the milk exactly to the upper line, which is marked 0. The cylinder is then stoppered and allowed to stand for twenty-four hours at a temperature of 70° F. The lower limit of the cream becomes sharply defined by this time, or, if not, an additional six hours should be allowed before reading off the percentage. By comparing the percentage of the cream with that of the fat, as determined by a chemical analysis of the same specimen, it has been found that the ratio of the cream to the fat is very nearly 5 to 3, and for clinical purposes it

may be so estimated. To estimate the proteids of milk following table can be used:

TABLE V. (HOLT).

How to Estimate the Proteids.

DATA.		CONCLUSION.
Percentage of Cream.	Specific Gravity.	Amount of Proteids.
High—*e.g.*, 8 to 10	High—*e.g.*, 1·033 to 1·034	High percentage
Low—*e.g.*, 3 to 4	High—*e.g.*, 1·033 to 1·034	Nearly normal
High	Low —*e.g.*, 1·027 to 1·030	Normal
Low	Low —*e.g.*, 1·027 to 1·030	Deficient

It follows from this table, therefore, that should the specific gravity be high and the fat or the cream abundant, then the proteids are abundant also. Should the specific gravity be high and the fats scanty, the proteids will be about normal, and should the specific gravity be low and the fats low also, then the proteids will be deficient. The most recent analyses of human milk give the following composition, quoted by Holt* (second edition, p. 130):

TABLE VI.

Composition of Human Milk.

	Average.	Common Healthy Variations.
Proteids - - -	1·50	1·00 to 2·25
Fat - - - -	4·00	3·00 ,, 5·00
Sugar - - -	7·00	6·00 ,, 7·00
Salts - - -	0·20	0·18 ,, 0·25
Water - - -	87·30	89·82 ,, 85·50
	100·00	100·00 100·00

* 'Diseases of Children.'

The proteids present are **casein** and **lactalbumin.** The casein is coagulated by acids, such as lactic and acetic, and also by the rennet ferment. It is present in the proportion **of one part of casein to two parts of lactalbumin,** and is in suspension in the milk in combination with the phosphate of lime. The lactalbumin is not coagulated by acids, or by the rennet ferment, and therefore it is present in whey, from which it is possible to precipitate it by boiling. According to Hirt, the amount of curd formed in human milk is only 0·63 per cent., the lactalbumin being 1·5 per cent. of the proteids. It is for this reason that the curd of human milk is soft and flocculent, and offers but little resistance to the digestive juices.

The fats are the glycerides of oleic, stearic, and palmitic acids. They are present in the form of fine globules—the milk corpuscles—which are surrounded by an albuminous envelope, and are in suspension.

Lecithin, an important ingredient of the brain and the nerves, is found dissolved in the fat, and a baby needs this element, as its nervous system is but poorly developed at birth. Human milk is rich in lecithin, but this is not so plentiful in cow's milk, as the calf is born with a fully-developed nervous system, and does not need it.

The Carbohydrates.—The only form of sugar found in human milk is **lactose,** which becomes converted into glucose, and in this form it enters the system by the blood of the portal vein. It is very soluble and readily absorbed, but at times it gives rise to the formation of lactic acid as a consequence of decomposition in the stomach or the intestines.

Salts.—These are sometimes spoken of as the mineral matter, or the ash. The following tables give the analyses of Harrington and Kinnicutt, and are taken from Dr. Rotch's work on 'Pediatrics,' p. 175. They are most complete.

TABLE VII.

The Ash of Human Milk.

Unconsumed carbon	0·71
Chlorine	20·11
Sulphur	2·19
Phosphoric acid	10·73
Silica	0·70
Carbonic acid	7·97
Iron oxide and alumina	0·40
Lime	15·69
Magnesia	1·92
Potassium	24·77
Sodium	9·19
Oxygen (calculated)	6·16

TABLE VIII.

Composition of the Ash, calculated from the above Analysis.

Uncombined carbon	0·71
Calcium phosphate	25·35
Calcium silicate	1·35
Calcium sulphite	2·11
Calcium oxide	1·72
Magnesium oxide	1·91
Potassium carbonate	24·93
Potassium sulphite	8·04
Potassium chloride	12·80
Sodium chloride	23·13
Iron oxide and alumina	0·40

The following table is designed to show the relative proportions of the salts in a shorter way :

TABLE IX.

Potassium salts	43·85
Calcium salts	30·24
Sodium chloride	23·13
Magnesium carbonate	3·77

It will be observed that the potassium salts are present in greatest amount, the explanation being that the young child requires a plentiful supply of them for its muscles, which are growing rapidly, and for its blood. The calcium salts come next in importance as bone-producers, and for cell growth. Nearly all the salts are in solution with the exception of the calcium phosphate. The milk secreted for the first few days is very rich in salts; after the first month the variations are slight, but show a gradual fall in the quantity present.

Presence of Bacteria.—Human milk may, for all practical purposes, be considered as sterile—that is, free from all pathogenic bacteria; but occasionally staphylococci may be found in it, and especially in that portion drawn at the beginning of each nursing. They probably find an entrance by the ducts in the nipple, and should unhealthy conditions arise, abscesses may result.

This, then, is the composition of human milk, from which it will be seen that it forms a food perfect in every particular. It goes without saying, therefore, that it is by far the best, as well as the most suitable kind of nourishment for the infant, and is the one it should get in every possible instance.

Quantity of Milk secreted.—This varies to a considerable extent in different women, and even in the same woman at different times and under varying circumstances. The daily amount secreted is usually between 1 pint and 1½ pints. Holt gives the following table as an average of the amount obtained during the nursing period:

TABLE X.

Quantity of Milk Secreted.

During the second week	...	about 13 to 18 ounces.
„ „ fourth „	...	„ 16 „ 26 „
„ second and third months	... ...	„ 20 „ 34 „
During the fourth, fifth, and sixth months	... ...	„ 24 „ 38 „
During the seventh, eighth, and ninth months	... ...	„ 30 „ 40 „

The most reliable method of estimating the quantity of milk taken by the child at each nursing is to weigh it accurately immediately before it is put to the breast, and again immediately after it has finished sucking, when the difference in weight will represent the amount of milk taken. Calculations based upon the capacity of the stomach in infancy, either during life or after death, are not of much value for the purpose, as it has been found that the stomach varies much in size; nor is the amount of milk in the breasts at any given time a certain guide. No hard and fast rule can be laid down as a standard of the quantity of milk required, because small and weakly infants will, of necessity, need less than those which are large and strong; indeed, this is exemplified by the breast, which is a self-regulating mechanism, secreting more or less milk according to the demands made upon it.

Variations in the Quantity of Milk secreted.—As will be seen by referring to Table X., the quantity of milk secreted rises gradually throughout the nursing period, somewhat rapidly during the first month, and thereafter more slowly. It is by supplying the infant with an increasing quantity that its demands for more nourishment are met, and not by providing an improving quality, so that the practice of increasing the strength of artificial mixtures from month to month is theoretically unsound. Very conflicting statements have been made by different observers as to the influence of diet, drugs, age, and varying states of the health of the mother upon the secretion. Dr. Cautley, in his excellent work on 'The Feeding of Infants,' deals with this part of the subject very fully; the following is abridged from his book, p. 81 *et seq.*:

The quantity of milk secreted can be increased by—

1. **The ingestion of an increased amount of fluid** such as milk, gruel, cocoa, chocolate, and animal broths, and also by a moderate use of stimulants, such as porter, ale, white wines, burgundy, or port.

2. **By improving the general health and nutrition,** as by tonics.

3. **By galactagogues**—that is, by drugs which directly

influence the secretion of milk. Pilocarpin is the drug chiefly employed for this purpose. Two or three subcutaneous injections of $\frac{1}{6}$ grain of the nitrate of pilocarpin on successive days may be sufficient in recent cases; in those of longer standing ten or twelve such injections may be required. No ill effects have been noted as resulting to mother or child from the treatment. The dose must be sufficient to produce some heat of the face, or the body.

4. **By electricity.** It may be applied by the ordinary sponge electrodes, or by means of a special spherical copper cap accurately fitted to the breast. The current may be applied for five minutes daily; it should not be strong enough to cause contraction of the pectoral muscles or pain.

5. **By frequent suckling.**

The quantity of milk secreted may be diminished by: the internal administration of saline cathartics, such as Epsom salts or effervescing citrate of magnesia. A full dose may entirely arrest the secretion for a time; therefore such drugs should be used with care and moderation during the lacteal period. Preparations of belladonna or atropine taken internally or applied locally are of very great value in lessening the secretion. All these measures are of special service when the infant is weaned suddenly, and the breasts consequently become tense and painful.

Effect of Menstruation.—With a return of the catamenia it is not unusual for the nursing child to suffer from indigestion and diarrhœa, or occasionally it may become seriously affected. More commonly, no effect upon the child is apparent. According to Vermois and Becquerel, the milk becomes poorer in lactose and richer in casein and fat. Rotch found that the fat was diminished considerably, the lactose slightly, and the proteids were increased. Considering how common it is for babies to continue sucking during the mother's menstrual period, it may be laid down as a general rule that the onset of the catamenia is no bar to the continuance of breast-feeding. It is rarely necessary to wean except when every catamenial period is the cause of acute gastro-enteric disturbance in the child.

Effect of Pregnancy.—Should the mother become

pregnant during the period of lactation, in many cases there is no doubt that weaning is essential for her sake, and can be advised without detriment to the child. Supposing, however, the child is gaining weight, and is contented, and the mother's health is not suffering, then suckling may be prolonged to the fifth, or even the sixth, month of pregnancy, and especially if the infant is delicate or the weather is hot. There is a slight risk of reflex miscarriage being set up by suckling.

Effect of Food.—Increase in the ingestion of proteid food not only leads to an increased secretion of fat, but also to an increase of proteid in the milk. The presence of curds in the stools is a very good indication of the indigestible quality of milk containing an excess of proteid. Vegetables in excess tend to decrease both the fats and the proteids, while insufficient nourishment leads to a marked deficiency of fat, and it may be of the proteid also.

Effect of Irregularity of Nursing.—Increasing the frequency with which the breast is given causes an increase in the percentage of the solids in the milk, especially the proteids, or, in other words, the more frequent the suckling, the more indigestible the milk becomes, the gland being stimulated to excessive metabolism with increased secretion of proteids. The common practice of giving the child the breast for the purpose of appeasing it whenever it cries is, therefore, wrong, and only aggravates the colic from which it suffers. A much better plan is to give the child a spoonful or two of hot water, and to adhere strictly to regularity of nursing. The following table shows the methods for altering the composition of human milk, and is convenient for ready reference :

TABLE XI.

The percentage of proteid is increased by—
Increased frequency of nursing.
Increased ingestion of proteid food.
Insufficient exercise.

The percentage of proteid is diminished by—
Diminished frequency of suckling.
Diminished ingestion of proteid food.
Increased exercise.

The percentage of fat is increased by—
Increased ingestion of proteid food.
The percentage of fat is diminished by—
Deficiency of proteid food.
Excess of fatty food.
Fasting.
The percentage of water is increased by—
Increased fluid diet.
The percentage of water is diminished by—
Diminished fluid diet.
Saline cathartics.

Effect of Alcohol.—The effect of alcohol is partly to increase the quantity of the milk, and partly, also, to increase the proportion of fat in it. The two indications for the use of alcohol are the health of the mother and the quality of the milk. If, after careful investigation, it is found that the mother's strength and health are not able to support the fatigues of nursing and the supply of a suitable milk in sufficient quantity for the infant, and that the addition of light ale, stout, or some kind of wine, will enable her to continue nursing, such treatment must be insisted on rather than allow the child to be weaned. The stimulant should be given at meal-times only, and in small quantity, such as one glass of light wine or half a pint of ale or stout.

In the great majority of nursing women alcohol in any shape or form is not required, and in any case its use should be discontinued at the earliest moment possible. A grave responsibility rests with the medical man who recommends it, as the dangers of inducing a habit are very considerable.

On the other hand, I take the following from Dr. Hutchison's able work on **Food and Dietetics,** p. 149 *et seq.*, based on the careful observations and analyses of Baumm and Illner.

'Weak women seem to furnish as good milk as those who are robust and strong, and the milk of women who have borne many children is but little poorer than that of those who are nursing their first infant. Age, also, has little influence, for the milk of women approaching the climacteric has not been found inferior to that of

mothers hardly out of their teens. Illness, menstruation, pregnancy, fever, and even severe emotional disturbance, are also almost entirely devoid of any appreciable effect on the composition of the milk. The most striking fact about the composition of the milk, indeed, is its independence of outside influences.'

Again, quoting Baumm and Illner, Dr. Hutchison writes:

'They fed various nursing women on the following diets, and analyzed the milk produced on them:

'1. An ordinary mixed diet taken in great abundance.

'2. A highly nitrogenous diet—*i.e.*, cheese, eggs, and meat.

'3. A diet rich in carbohydrates and fat, but poor in nitrogen—*i.e.*, plenty of bread, farinaceous food, sugar, and butter.

'4. A very fluid diet.

'5. An ordinary diet plus 2 to 3 pints of lager beer daily.

'6. A diet consisting largely of salt fish, pickles, and other salt foods.'

They found that, on the whole, fat was the only ingredient of the milk on which the diet produced any appreciable effect, and that the composition of the milk yielded is to a large extent independent of the diet. Even if the supply of food is, to a large extent, cut off, the mother goes on producing milk just as before, only at the expense of her own tissues, as was observed amongst the starving women during the siege of Paris. The influence of alcohol on the secretion and composition of milk is very slight, and Klingemann, from experiments, could find no appreciable amount even after considerable quantities of alcohol had been taken.

These, then, are the views of different eminent authorities on this part of the subject, and they are left with the reader to form his own conclusions upon them. Before passing on to another chapter I will conclude this one by saying that **human milk is the most perfect, and at the same time the most natural, food for the infant, and the one it is entitled to, and should get, except under certain conditions which will be considered hereafter.**

CHAPTER IV

THE MANAGEMENT OF NATURAL OR BREAST FEEDING

The management of breast feeding—The method of nursing—The frequency of nursing—The duration of breast feeding—Mixed feeding—Weaning—Contra-indications to breast feeding—Wet-nurses—Rules for choosing one.

THE child should be put to the breast in two or three hours after its birth, by which time the mother will have recovered sufficiently from the fatigues of labour. This to some may seem a very short respite, but by putting the child to the breast thus early many advantages are gained. **In the first place**, the act of suckling is a reflex stimulant to the uterus, and diminishes the risks of post-partum hæmorrhage. **Secondly**, the secretion of milk is stimulated. **Thirdly**, the breasts are lax at this time, so that the child can the more readily catch and draw out the nipples, whereas after a few days the breasts will be swollen with the formation of milk, and the nipples will be depressed below the surface, so as to render it difficult, or even impossible, for the infant to catch them. **Fourthly**, the fluid obtained by the child for the first few days—**the colostrum**—has a decidedly laxative action, which is beneficial in expelling the meconium, while it supplies the baby with all the nourishment required, and may even enable it to gain weight. The very common practice of giving the newly-born child a dose of castor-oil or other purgative is quite unnecessary, and may be positively injurious. There is a very general idea abroad that the infant should be given something in the way of nourishment for the first week after birth, until the secretion of the breasts

becomes fully established, and this generally is provided in the form of cow's milk, sugar, and water. It is seldom necessary to do so, but should the flow of milk be slow in becoming established, or should the child be weakly or premature, the best food to give it will be a little **whey**, to which is added some sound cream; or even some milk-sugar and water in the proportion of 5 per cent.

The Method of Nursing.—When the infant is put to the breast, it should lie on its side, and have its head and back supported by the mother's arm. The mother should lean a little forward to allow the nipple to fall easily into the infant's mouth, and she should regulate the flow of milk through the nipple by gentle compression with the fingers. Should the milk flow with difficulty, gentle pressure on the breast will assist it, and, on the other hand, should it come too quickly, a little compression of the nipple between the fingers will control it. The breasts should be given alternately, and, as a rule, the child may with safety be permitted to nurse until satisfied, which it generally is in from ten to fifteen minutes. After each nursing the nipples should be carefully washed and dried. When the secretion has become fully established, successful nursing depends to a very large extent upon the regularity with which the infant is put to the breast. As has been already pointed out, too-frequent nursing alters very materially the composition of the milk in the direction of making it indigestible, and, besides, the child's stomach is not allowed sufficient rest. For these and other reasons regularity in the feeding of infants becomes of the first importance, and mothers should be especially warned against the common practice of giving the breast whenever the child cries, with the idea of appeasing it; for though this may seem to soothe it for the time being, the condition, which is one of indigestion, will be aggravated in the long-run.

The Frequency of Nursing.—No hard and fast rule need be insisted on as a guide in every instance. When the child is strong and vigorous, it should be put to the breast every two hours during the day, and once during the night, until it is six weeks or two months old. The day feeding may be reckoned from 6 a.m. to 10 p.m. From the eighth to the twelfth week, every two and a half

hours will be sufficient, and by the fourth month the interval may be extended to every three hours, and this interval should be maintained for the remainder of lactation. The following table is taken from Dr. Rotch's work on 'Pediatrics,' p. 182 :

TABLE XII.

(The day feedings begin at 6 a.m. and end at 10 p.m.)

Age.	Intervals.	Number of Feedings in 24 hours.	Number of Night Feedings.
From birth to 4 weeks	2 hours	10	1
„ 4 to 6 „	2 „	9	1
„ 6 to 8 „	2½ „	8	1
„ 2 to 4 months	2½ „	7	0
„ 4 to 10 „	3 „	6	0
„ 10 to 12 „	3 „	5	0

Should the infant be weakly or premature, it will be necessary to put it to the breast at somewhat more frequent intervals, such as every hour and a half for the first month, and in cases of great debility it may be advisable to draw off the milk with a breast-exhauster, and give it to the infant from a spoon or with a medicine-dropper.

The Duration of Breast Feeding. Under favourable conditions the mother should continue to nurse her child for nine months, during which time it should get no other food of any kind. The best criterion that the milk is of good quality and sufficient in quantity is the condition of the child, which should be one of steady growth and increase in weight. It is therefore very important to weigh the child at stated intervals, say once each week. It often happens, however, that the mother is unable to bear the strain of nursing for the full period, or the secretion may become scanty or of poor quality. Under such circumstances mixed feeding may be resorted to—that is, giving the breast and the bottle alternately, and after the sixth month this method is generally quite successful, the reason being that by this time the child's stomach has become more of a receptacle and its powers of digestion

much stronger. It is a very rare occurrence that a mother is unable to suckle her offspring for a few months at least, and as it is exceedingly difficult to provide a satisfactory substitute for the breast during the early weeks of life, apart from a wet-nurse, no effort should be spared by mothers to perform this duty even for one month, the breast-fed child having an enormous advantage over one which is brought up on the bottle. On the other hand, it is a mistake to prolong the period of suckling unduly, and, speaking in a general way, the tenth or the eleventh month should not be exceeded, because the health of the mother is apt to suffer on account of the drain on her system, and the child, because of insufficient nourishment, becomes anæmic and flabby, or even rachitic.

Mixed Feeding. It is no uncommon circumstance that the supply of milk, while of good quality, is found to be insufficient in quantity, and the question arises, Should breast-feeding be entirely given up, or should it be supplemented by other food? No difficulty need be experienced in answering this question, in favour of supplementing the natural food by one similar to it in composition, and Dr. Rotch says 'he has found that, where the substitute food is carefully regulated, this method is superior to that of withdrawing the mother's milk and feeding the infant exclusively upon a substitute food.' An effort should, however, be made to increase the quantity of the breast milk on the lines laid down on pp. 25 and 26, before adopting the plan of mixed feeding.

The management of mixed feeding is conducted as follows: A careful analysis is made of the mother's milk, and if it is agreeing with the child—in other words, if the child has been gaining steadily in weight—the substitute food is made to correspond as closely as possible in composition with it. The substitute food should be given in such quantities as may be found necessary to supplement the maternal feedings, and the infant's motions should be examined from time to time to ascertain if the milk is being fully digested. When the mother's milk is deficient in quantity, the intervals between the nursings should be lengthened, and a substitute feeding introduced, and when the nursings have been reduced to only two or three

in the day, the secretion should be examined frequently as it is apt to become poor in quality very quickly.

Weaning.—This is usually begun at the end of the ninth month. When the supply of breast milk is ample, and especially when the child continues to thrive and appears quite satisfied, there can be no objection to continue with the breast for another month or two. Weaning may be carried out either gradually or suddenly.

1. **Gradual Weaning.**—This is the method to be recommended in the great majority of cases. The process should occupy several weeks, one feeding being substituted for one nursing, then another, and so on until the mother is entirely relieved. The following table is taken from Dr. Cautley's work,* and shows the method very well:

TABLE XIII.

Method of Gradual Weaning.

Hour.	First Week.	Second Week.	Third Week.	Fourth Week.	Fifth Week.
5 a.m.	Breast	Breast	Breast	Breast	Breast
8 a.m.	Mixture	Mixture	Mixture	Mixture	Mixture
11 a.m.	Breast	Breast	Breast	,,	,,
2 p.m.	,,	,,	Mixture	,,	,,
5 p.m.	,,	,,	Breast	Breast	,,
8 p.m.	,,	Mixture	Mixture	Mixture	,,
11 p.m.	,,	Breast	Breast	,,	,,

This method of gradual weaning is much better for the mother, whose breasts are likely to become tense and painful should the weaning be abrupt, and by adopting this plan the child's stomach will more readily adapt itself to the altered food. It is much better to wean in cool weather than when it is warm, because of the liability to fermentative changes in cow's milk in summer, nor should weaning be commenced at a time when the child is erupting teeth. It need hardly be said that during, or immediately after, attacks of sickness weaning should not be under-

* 'The Feeding of Infants,' p. 111.

taken. In deciding what shall be the composition of the substitute food, advantage may be taken of the information gained by a careful analysis of the mother's milk, and then prescribing an artificial food on the same lines. The following table shows the composition of a suitable mixture for a child of nine months :

TABLE XIV.

Mixture for Weaning.

Cow's milk	... 3 ounces.
Cream (15 per cent.) ...	... 1 ounce.
Lime-water	... 2 ounces.
Lactose, or cane-sugar	... 1 teaspoonful.

This quantity should be given warm at each feeding out of a perfectly clean bottle, and the amount may be rapidly increased to 7 or 8 ounces should the child appear not satisfied. It occasionally happens that weaning upsets the child's digestion, and it gets an attack of diarrhœa or vomiting. Under such circumstances the breast may be resumed for a day or two until the attack passes off, or the mixture may be persevered with, but in a more dilute form, so as to reduce the percentage of fat and proteid.

2. **Sudden or Premature Weaning.**—It may become advisable to wean the child at a much earlier date than has been recommended, or it may be necessary to wean it abruptly. The causes for this may pertain to (*a*) the mother or (*b*) the child.

(*a*) The mother may become stricken with an acute febrile disease, such as typhoid fever, pneumonia, or influenza ; she may become afflicted with acute tuberculosis, kidney disease, cancer, or affections of a pyæmic nature ; or she may be too debilitated to bear the strain of nursing. Syphilis, if contracted after the birth of the child, requires that the child be weaned ; otherwise it may become affected. Should pregnancy ensue, it is generally advisable to wean, for reasons already stated (see p. 26).

(*b*) The child should be weaned if it ceases to gain or actually loses weight. Under either of these conditions it becomes peevish and fretful, it remains too long at the breast, and leaves it with appetite unsatisfied. Before deciding upon weaning, however, an effort should be made

to improve the composition of the mother's milk through the medium of her diet (see p. 27).

Contra-Indications to Breast Feeding.—Tuberculosis is the great bar to breast feeding, and should there be the slightest suspicion of its presence, the woman must be strictly prohibited from nursing. Even in the absence of any active symptoms, the presence of a family history of tubercle, or of past lung trouble, renders it advisable to rear the child artificially. The wear and tear of suckling, especially when long continued, is a considerable tax upon the strength, and may develop a constitutional delicacy into an active tuberculosis.

Constitutional Syphilis affects both the quality and the quantity of the milk in most cases, and, as a rule, the child will thrive better on an artificial diet. It is, nevertheless, true that many women do suckle their infants successfully while suffering from this disease.

Nervous Affections.—It is generally admitted that the secretion of milk is readily affected by nervous disturbances, such as emotional outbursts, and for this reason neurotics make indifferent nurses. A family history of insanity should warn us against subjecting such a mother to the strain of nursing, as melancholia not infrequently supervenes, and there is such a thing as the insanity of lactation. Epileptics should on no consideration be allowed to nurse their children, for obvious reasons.

In addition to the above, there are a few other contra-indications to breast feeding which may be mentioned. Fissure of the nipples is a very painful condition, and one which generally renders suckling impossible. Mammary abscess and malignant or tuberculous disease of the breast absolutely preclude suckling. It remains only to mention that occasionally the secretion is scanty from the first, and may disappear entirely after a few weeks.

Wet-Nurses.—If for any reason the mother is unable to suckle her infant, the ideal substitute, undoubtedly, is the milk of some other woman. In the present day, however, foster-mothers are not much in evidence, for two reasons: **Firstly,** because they are difficult to obtain just at the time they are wanted; it means the introduction of a stranger into the family circle; it is expensive, and the antecedents of the woman are frequently difficult to

obtain, or they may not be above suspicion. **Secondly,** the advances of chemical science have made it possible to provide the infant with a diet suitable to its digestive powers, and of the requisite quality and quantity. Should, however, a wet-nurse be decided upon, the onus of choosing one generally falls upon the medical man, and it, therefore, is of importance to be aware of the qualifications which she should possess. She should not be under twenty-one or over thirty-five years of age; her own child should be about three months older than the one she is to foster; she should by preference be a multipara rather than a primipara, as the experience of a former nursing will be of advantage; her breasts should be of moderate size, and give evidence to the touch of a good proportion of glandular, and not too much adipose, tissue; the nipples should be well formed and free from fissures or abrasions of any kind, and on gentle pressure the milk should flow freely. The supply of her milk may be estimated by weighing her own child immediately before and after suckling, and its quality, by observing if the infant is satisfied and falls off to sleep at the conclusion of the nursing. Should any doubt exist on these points, a microscopical and chemical examination of her milk may be made, though this is seldom necessary. She should be strong and robust, have a placid and easy-going disposition, and be active, and cheerful, and temperate in all respects. The diet of the wet-nurse should be liberal but plain, and she should take exercise in the open air every day. Alcoholic stimulants are quite unnecessary for her, and should be strictly prohibited. Her throat, limbs, the glands of the neck, and, if necessary, her genital organs, should be examined, that strumous or syphilitic disease may be excluded. Her own infant should then be seen, for its appearance supplies one of the best estimates of her capacity to nurse. It should be plump, have well-rounded limbs, and healthy skin and mucous membranes; in other words, it should be of sufficient weight for its age, and be without the least suspicion of either rickets or syphilis.

CHAPTER V

ARTIFICIAL FEEDING

Artificial feeding—Composition of cow's milk—Modification of cow's milk—Dilution with plain water—Gaertner's mixture—Cautley's mixture—Rotch's mixture—Meig's mixture—Soxhlet's mixture—Biedert's formula—Ashby and Wright's humanized milk—Other diluents than plain water—Whey—Its composition—Whey mixtures—Different breeds of cows—Their milk compared—The 'American' or 'percentage' method—Home modification of milk—The quantity of Food to be given—The number of feedings in the twenty-four hours.

WHEN, for any reason, the mother is unable to suckle her infant, a substitute for the breast becomes necessary, and the milk of the cow is that selected in nearly every instance, because it is the most available for general use. A very prevalent idea exists in the public mind that an infant should be reared **on the milk of one cow**, and especially so if it be delicate. This is a complete, if unexploded, fallacy, on which Dr. Cautley* writes as follows: 'Milk from one cow involves a maximum degree of variability, whereas by taking the mixed milk of a herd, the larger the better, a much more uniform standard is obtained.'

Composition of Cow's Milk.—Cow's milk contains the same proximate principles as human milk, but it differs materially in the percentage of some of its constituents. The following table is taken from Holt, as being the approximate composition of cow's milk according to the most recent analyses:

Loc. cit., p. 133.

TABLE XV.

Cow's Milk.

Proteids	3·50
Fat	4·00
Sugar	4·50
Salts	0·75
Water	87·25
	100·00

The normal reaction is neutral or slightly acid when the milk is quite fresh, but it should never be strongly acid. On the other hand, should it be strongly alkaline, adulteration may be confidently suspected. The specific gravity is from 1·028 to 1·033. Cow's milk is much whiter in colour than human milk, owing to the larger quantity of calcium phosphate which it contains, and it is not so sweet to the taste as breast milk, because of the smaller amount of sugar in it. The most important difference, however, between the two milks is in the proteids which they contain.

The Proteids.—These are present in two and a half times the amount of those in human milk ; and not only so, but they differ very materially in character. It has already been pointed out that the proportion of lactalbumin to casein in human milk is as two to one, whereas in cow's milk the insoluble casein is nearly five times as abundant as the soluble lactalbumin. This is well shown in the following table :

TABLE XVI. (KÖNIG).

Human Milk.		**Cow's Milk.**	
Lactalbumin ...	1·31	Lactalbumin ...	0·75
Casein	0·63	Casein	3·02

This is the most important difference between the two milks, and the one to which is attributed the great difficulty experienced in modifying cow's milk to suit an infant at birth **The casein**, as has been already seen, is coagulated by acids, by the rennet ferment, and by the gastric juice, and as a consequence, when it enters the stomach, the curd formed is tough and firm, and is but

indifferently acted upon by the digestive fluids. It is further stated that the casein differs somewhat in the two milks, the casein of cow's milk leaving behind an indigestible residue called **paranuclein**, whereas the casein of human milk does not.

The Fat is in much the same quantity in the two milks —that is, 4·00 to 4·50 per cent. Cow's milk contains a larger quantity of the volatile fatty acids, and the fat globules are smaller than those of human milk. Lecithin is present in the fat, but not to the same amount as in breast milk.

The Sugar of both cow's and woman's milk is identical in composition, but the former contains much less than the latter, and hence is not so sweet.

The Salts in cow's milk are a little more than three times as abundant as in human milk. They contain a much larger amount of calcium phosphate, and a smaller amount of potassium salts and of iron oxide.

Cow's milk always contains a large number of bacteria, which increase rapidly in proportion to the freshness of the milk, it being a good medium for their growth. From the above facts it will be evident that very considerable modification is required if cow's milk is to be made a suitable food for infants. That this is not easy of accomplishment is testified to by the number of books which have been written, and the amount of work which has been done in the field of the artificial feeding of children.

Modification of Cow's Milk.

In order to prepare a mixture from cow's milk which will be as nearly as possible identical in composition with human milk, the following methods have been adopted:

Dilution with Plain Water.—This is the earliest and simplest method, and the one which is in almost universal use among the poor. The water, which should first be sterilized, is added in the proportion of two parts to one of milk, and the mixture is sweetened by the addition of cane-sugar, though sugar of milk is to be preferred. The following table shows the percentage of proteids and fat in such a mixture:

TABLE XVII.

Artificial Mixture No. 1.

Proteids	...	1·75 per cent.
Fat ...	...	1·75-2·00 per cent.
Reaction	...	Acid.

A glance at this table is sufficient to show that the mixture is very deficient in the essential element of fat. It should also be remembered that the cow's milk used is presumed to be good, whole, sound milk. Those who have had a large experience at the out-patient department of a children's hospital in any of our big cities will, I feel sure, bear me out when I say that many of the poor purchase, not whole, but skim milk, and make the mixture from it, with the result that the infant is reared on a food practically devoid of fat. With regard to the proteids, it will be seen from the table that they are present in about the same proportion as in breast milk, but, as has been pointed out already (see p. 39), the amount of casein is much more than a young infant can be expected to digest. The sugar is always present in excess, and to this may be attributed the moderate degree of fatness which many of these hand-fed infants exhibit. It may be asked, How, then, do these infants survive on such nourishment? I think the answer is to be found in the enormous quantities of the mixture which are taken. Bottleful after bottleful is given, much of which is vomited in the form of an acid, curdy, fluid; and, if the napkins are examined, the child will be found to be passing large quantities of undigested curd in its motions, which are generally loose, sour-smelling and copious. Nevertheless, it would seem that a certain amount of nourishment is eliminated and absorbed, but the child grows up puny, and very probably rickety. I think there is here a great field for useful work by the health departments of our municipalities, if they would endeavour to supply the poor with (*a*) whole, sound, cow's milk and (*b*) sound cream containing 15 per cent. fat. The poor are quite ignorant of the value of cream in the rearing of their infants, and the price of it puts it beyond their means to buy. It is for these reasons that they prefer to buy skim in preference to whole milk, as a large

quantity of it can be obtained for one penny, and they consider it is quite good enough, and quite strong enough, for a baby. Using good, whole, dairy milk as a basis, the following form of mixture may be recommended, the quantity being suitable for each feeding :

Cow's milk, one tablespoonful, or ½ ounce.
Cream (15 per cent. fat), one teaspoonful.
Water (which has been boiled), two tablespoonfuls.
Sugar of milk (cane-sugar will do), one teaspoonful.
Bicarbonate of soda (baking soda), a pinch.

This mixture should be made fresh for each feeding, and it should be sterilized before giving it to the infant. The following table shows the approximate composition :

TABLE XVIII.

Artificial Mixture No. 2.

Proteids	1·75 per cent.
Fat	3·50 per cent.
Sugar	6·00 per cent.
Reaction	Alkaline.

The digestibility of such a mixture is still, however, inferior to that of milk from the breast, and to make it more digestible it is better to dilute the milk with lime-water, which has the power of preventing the clotting of milk, and, besides, it neutralizes the acidity of cow's milk.

Barley-water may be used as a diluent also, but it is inferior to lime-water, though it seems to have the power of preventing clotting to a certain extent; it is, however, contra-indicated at this early age. Many infants, especially if they be strong, take such a mixture and thrive upon it quite well; but in the case of those which are weakly or premature further dilution will be necessary, and for such, a mixture of one part of milk, two parts of water, and one part of lime-water is to be recommended, cream and sugar being added as before. The dilution of three to one advised above reduces the proteid in amount to a little below that present in human milk, but in consequence of the differences in the proteids already

referred to, still further dilution is frequently desirable, especially during the first few weeks of life.

Dr. Holt* writes as follows: 'I have obtained the best results by making the proteids for the first few days only 0·33 or 0·55 per cent.; then, as the stomach becomes somewhat accustomed to cow's milk, gradually raising the proportion, until before the end of one month the child is usually taking 1·0 per cent., by the end of the second or third month 1·5 per cent., and by the end of the fourth or fifth month 2 per cent., proteids. It is seldom that the total quantity of proteids present in cow's milk can be given before a child is a year old. I believe the secret of success in feeding with cow's milk is, to begin with the proteids so low as not to disturb the infant's digestion, and then slowly, but steadily, to raise the quantity.' Writing on the same subject, Dr. Cheadle† says: 'When a young infant is first placed on artificial food, peptonized milk and water is the best and safest substitute for human milk in the first instance.' And again at p. 63, in speaking of the common mixture of milk and water (see Table XVII.), he says: 'I think it may be safely affirmed that this reckless and almost universal practice of placing infants, and especially very young infants, abruptly, and without preparation, upon fresh cow's milk and water, is one of the most fruitful causes of the serious food troubles of childhood, and a most prolific source of disease.' My object in quoting these high authorities is to emphasize the great importance of beginning with such a mixture at first as will be capable of digestion by the infant; otherwise its stomach will become irritated by its efforts to digest the casein, with the result that vomiting and diarrhœa may be set up. Such a contingency will be found very difficult to counteract at this tender age, and it may be that the stomach, for long after, will show great intolerance to cow's milk in any form except when peptonized. The modification of cow's milk on the lines laid down possesses the advantage of being simple, and can be carried out at home by any mother of ordinary intelligence. Many other methods have from time to

* 'Diseases of Infancy and Childhood,' 2nd ed., p. 181.

† 'Artificial Feeding,' 5th ed, p. 60.

time been devised by various workers, and a few of these may now be considered.

Gaertner's Mixture.—This is prepared as follows: Equal quantities of milk and sterilised water are poured into a centrifugal separator, which is made to revolve so that the outgoing streams are equal. The two portions have the following composition :

TABLE XIX.

	Proteid.	Fat.
Before separation : Original milk ...	3·6	3·5
„ diluted	1·8	1·75
After separation : Fettmilch, or cream portion ...	1·8	3·3
Magermilch, or skim-milk portion ...	1·8	0·2

Cautley's Mixture is prepared as follows: An equal quantity of cow's milk and a 9 per cent. solution of sugar of milk is passed through a separator, so arranged that the outgoing streams are equal. One portion contains all the cream, and may be called 'cream milk,' while the other portion contains practically no cream, and may be called 'skim milk.' The composition of the two fluids is as follows :

TABLE XX.

Cautley's Mixture.

	Original Cow's Milk.	Separated Milk.	
		Cream Milk.	Skim Milk.
Proteids	4·0 per cent.	2·0 per cent.	2·0 per cent.
Fat ...	3·7 „	3·5 „	0·2 „
Sugar...	4·4 „	6·7 „	6·7 „
Salts ...	0·7 „	0·35 „	0·35 „

This an excellent mixture, and is well taken and digested by infants ; it is rendered faintly alkaline.

Rotch's Mixture is prepared as follows :

TABLE XXI.

Rotch's Mixture.

Cream (20 per cent. fat) ...	1½ ounces.
Milk	1 ounce.
Water	5 ounces.
Milk-sugar	3⅜ drachms.
Lime-water	½ ounce.

This is a good mixture, and is stated to have the following composition :

TABLE XXII.

Proteid	1·2 per cent.
Fat	4·2 „
Sugar	6·5 „

It is too rich in fat for use at an early age.

Meig's Mixture is prepared as follows : A quart of sound milk is allowed to stand for three hours in a tall vessel and in a cool place. At the end of this time the upper half is siphoned off, and which, of course, is rich in cream. To every 1½ ounces of this he adds 1 ounce of lime-water and 1½ ounces of sugar-water. It is poor in proteid, but is a useful mixture for infants from birth to the end of the first month. The following table shows its composition :

TABLE XXIII.

Meig's Mixture.

Cream milk (15 per cent. fat) ...	1½ ounces.
Lime-water	1 ounce.
Sugar solution (lactose 18 drachms, or eight heaping teaspoonfuls to the pint of water)	1½ ounces.

Composition.

Proteids	1·21 per cent.
Fat	3·50 „
Sugar	6·66 „
Ash	0·25 „

Soxhlet dilutes the milk with half its volume of a 12½ per cent. solution of milk-sugar. This makes the proportion of proteid correspond to that in human milk, but

leaves the fat one-third less and the sugar one-half more. It is a very simple form of mixture, and very favourable reports have been published of it as an infant food.

Biedert's Formula is as follows :

TABLE XXIV.

Biedert's Cream Mixture.

Mixture.		*Composition.*	
Cream ...	1 ounce.	Proteids...	1·8 per cent.
Milk ...	1 „	Fat ...	2·7 „
Water ...	3 ounces.	Sugar ...	3·8 „
Milk-sugar...	1 drachm.	Salts ...	0·14 „

This mixture is poor in fat and deficient in sugar ; the proteid is too high for very young children. The defects can, however, be readily remedied by the addition of cream, sugar, and lime-water in suitable quantities.

Ashby and Wright* give the following directions for preparing 'humanized' milk : Stand 30 ounces of good fresh milk of average quality, as soon as it arrives at the house, in a glass bottle (see figure). A stopper of clean non-absorbent cotton-wool is placed in the neck of the bottle ; it is allowed to stand without being disturbed for five hours in an ice-chest or in as cool a place as possible. By the end of this time a certain amount of cream will have risen to the top. Then carefully, and without disturbing the bottle, siphon off the lower half, that is, 15 ounces, and replace this by an equal quantity of a 7 per cent. solution of sugar of milk (1 ounce of sugar of milk in 15 ounces of water). The composition of this mixture is as follows :

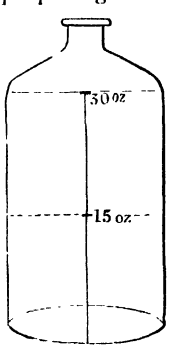

TABLE XXV.

Ashby's Mixture.

Proteids	1·8 per cent.	
Fat	3 to 3·5	„
Sugar	6·0	„

* 'Diseases of Children,' 4th ed., p. 49.

It is rendered alkaline by the addition of a few grains of bicarbonate of soda or a few drops of a saccharated solution of lime. This is an admirable mixture, and is not difficult to make.

Another method may be described which has the recommendation of being easy to understand; it is advocated by **Monti, Vigier, and Winter.** Take a quart of good sound milk and divide it into two equal portions; allow them to stand in a cool place for three hours. At the end of this time remove the cream from one portion and add it to the other; the former portion is then clotted with rennet—that is, the casein is removed from it—and the resulting whey is added to the latter portion. This mixture may be taken as containing practically all the fat and sugar and half the proteids of the original milk.

It will have been noticed that in the preparation of some of the above mixtures a centrifugal separator is made use of to obtain the cream. While, undoubtedly, this is the most efficient means of separating the cream from the milk, it would seem that milk which has been passed through a separator suffers some deterioration in the element of fat, the process destroying, more or less, the natural emulsion of the cream.

By any of the methods now described the amount of the proteid can be reduced to the same proportion as that present in human milk; but while this is accomplished, they do not alter the relative proportion of the two proteids, casein and lactalbumin, and therefore these mixtures must always remain more difficult of digestion than human milk. It is because of this that Dr. Holt recommends beginning with the very low percentage of 0·33 of proteid, and then very gradually raising the strength of the mixture, and there can be no doubt but that this is practically and theoretically sound. By reducing the proteid to this low percentage we do not in every case get over the difficulty, for even this small amount of casein of cow's milk coagulates in the infant's stomach in firm, tough masses. Various methods of surmounting this difficulty have been advocated, of which the three now to be described may be recommended:

1. **By using as a diluent, instead of plain water,**

barley or oatmeal water. It is claimed for these fluids that they prevent the curd from running together into lumps during the process of coagulation, or, as it is popularly called, 'they cut the curd.' Theoretically speaking, the use of these diluents at an early period of infancy is contra-indicated, inasmuch as they contain some unconverted starch, and the power of converting starch into sugar at this time is very feeble. Clinically, however, it is a fact that many children can certainly digest the proteids better when barley or oatmeal water is used to dilute the milk, and they possess a certain nutritive value. In addition to facilitating the digestion of the proteids, they tend to prevent constipation, which is not unusual in children taking low percentages, and as a result of this the colic and fretfulness associated with constipation are relieved. Barley-water or oatmeal-water is generally made much too strong, and in consequence defeats its object; they should be prepared according to the directions given in the Appendix.

2. **By removing the casein entirely from the milk by the action of rennet.** The fluid which remains after the casein has been removed from the milk is called **whey,** and the method of preparing it will be found in the Appendix. The following table shows its composition:

TABLE XXVI.

Composition of Whey.

Proteid (lactalbumin)			...	0·86 to 0·97
Fat	...	...	...	1·50 „ 2·00
Sugar	...	...	...	4·75 „ 5·50
Salts	...	...	...	0·48 „ 0·60

The fat is removed to a large extent by the process, but this deficiency can be readily made good by the subsequent addition of cream. Using whey as a basis, mixtures of varying strength can be made to suit infants whose powers of digesting proteids are small. The following table is taken from Holt:*

* 'Diseases of Infancy and Childhood,' 2nd ed., p. 208.

TABLE XXVII.

Whey Mixtures.

I. **Whey** 19 parts + 20 per cent. **cream** 1 part gives—
Fat 1·8, sugar 4·90, proteid 1·0.

II. **Whey** 15 parts + 20 per cent. **cream** 1 part gives—
Fat 2·2, sugar 4·90, proteid 1·0.

III. **Whey** 9 parts + 20 per cent. **cream** 1 part gives—
Fat 2·8, sugar 4·90, proteid 1·10.

IV. **Whey** 7 parts + 20 per cent. **cream** 1 part gives—
Fat 3·3, sugar 4·80, proteid 1·16.

V. **Whey** 5 parts + 20 per cent. **cream** 1 part gives—
Fat 4·0, sugar 4·80, proteid 1·25.

In the lower formulas (I., II., III.) the casein will be less than 0·25 per cent.; in the highest formula (V.) it will be barely 0·50. These formulas are very suitable for very young infants, or for those which are premature. Should it be considered desirable at any time to increase the amount of the proteid element in any of these mixtures this can be readily done by the addition of raw meat juice or egg-albumin water; for the preparation of these see Appendix.

3. **By partially or wholly predigesting the casein in the milk by means of peptonization.**—It is rarely necessary to resort to this except in the case of premature or weakly infants. The subject will be considered under the head of Peptonized Milk. It has been already pointed out (p. 39) that a better standard will be obtained by using the milk of a herd than that of any single cow; but as many people keep a cow for their own use, it may be advantageous before passing from the subject to say a few words on the milk of different breeds. The following is taken from Dr. Rotch's work on 'Pediatrics,' p. 226 *et seq.*

The Durham or Shorthorn.—This cow has great constitutional vigour, great capacity for food, a perfect digestion, is of a placid temperament, not easily frightened, and yields a large quantity of rich milk, the analysis of which is as follows:

TABLE XXVIII.

Fat	4·04
Sugar	4·34
Proteids	4·17
Ash	0·73

The Devon.—The colour is almost uniformly red, with the nose generally white. They are of medium size, have medium-sized udders, and are very gentle and vigorous. They have a fair capacity for food, are not easily frightened, and their digestion is good. They give a moderate quantity of milk of medium quality, the analysis of which is as follows :

TABLE XXIX.

Fat	4·09
Sugar	4·32
Proteids	4·04
Ash	0·76

The Ayrshire.—Their constitutional vigour is great, they have great capacity for food, a good digestion, but a rather nervous temperament. They have large udders, and yield a large supply of milk with the following analysis :

TABLE XXX.

Fat	3·89
Sugar	4·41
Proteids	4·01
Ash	0·73

The Holstein-Friesian.—This cow represents the most perfect milk-producing animal known. The fat globules are very small and evenly distributed, and the emulsion is perfect. They are very domestic and gentle. They have large udders, and yield a larger quantity of milk than any other known breed. The milk is rather poor in quality, as the following analysis shows :

TABLE XXXI.

Fat	2·88
Sugar	4·33
Proteids	3·99
Ash	0·74

The Brown Swiss.—They are very vigorous, stand cold well, are docile and not easily frightened. They are of medium size, are very healthy, and yield a fair supply of milk with the following analysis :

TABLE XXXII.

Fat	4·00
Sugar	4·30
Proteids	4·00
Ash	0·76

The Bretonne.—It is known as the 'cow for the family.' They are small, but have large udders, and yield a medium amount of milk of good quality.

The Jersey and Guernsey.—The milk of these breeds is rich in fat and proteids. They are not hardy, and therefore, when transported from their homes to countries where the climate is less genial, they are more liable to contract diseases, such as tuberculosis, than those already mentioned. The following table shows the composition of their milk :

TABLE XXXIII.

Fat	5·50
Sugar	4·50
Proteids	4·25
Ash	0·65

In addition to these there are the Kerry cow of Ireland, the Red Polled of England, the Dutch Belted, and the Flemish, each equally good in its own country.

Whenever one cow is kept, or set apart, for the supply

of milk for a child, the greatest care should be taken to see that she is sound and healthy; she should be examined by a veterinary surgeon, and show a negative reaction to the tuberculin test. Little less important than the health of the cow is the manner in which she is housed and fed, and the care that is taken to prevent contamination of the milk with organic matters. The days' supply of milk for the child should be kept in an ice chest, or in a bottle surrounded with iced water. This retards the growth of bacteria, and prevents the milk turning sour for a long time. Where an ice-chest is not available, the milk should be kept in cool, well ventilated cellars, or out of doors in the shade, always taking care that it is covered to prevent dust reaching it. It must on no account be kept standing in the kitchen or the nursery.

Physician's Prescription.		**Clerk's Formula.**	
Fat	4·00 per cent.	Modifying cream ...	7 oz. 7 dr.
Milk-sugar ...	7·00 ,,	,, milk ...	4 ,, 7 ,,
Proteids ...	1·00 ,,	Sugar solution ...	8 ,, 3 ,,
Mineral matter.		Lime-water ...	1 ,, 5 ,,
Lime-water.		Water	8 ,, 6 ,,
Reaction slightly alkaline.			31 oz. 4 dr.

Number of feedings	7
Amount at each feeding ...	4½ oz.
Heated at	167° F.
Time in sterilizer	20 minutes.

Remarks.

It remains now to refer to the **American or percentage method of milk modification**, by which the infant can be provided not only with a good imitation of human milk, but with a mixture the proportions of the different constituents of which may be varied at will so as to suit weak digestions or abnormal conditions. This method is carried out through the medium of milk laboratories, and

is the outcome of the great and untiring labours of Dr. Rotch, of Boston, U.S.A., who has reduced this subject to an exact science. A mixture can be prepared at the laboratory of whatever composition is desired, by stating the amount of proteid, fat, and sugar it is to contain per cent., the quantity required for each feeding, and the number of feedings for each day, and this mixture is dispensed with the same accuracy as the chemist compounds a prescription. Where expense is not a consideration, then laboratory feeding is well-nigh ideal; but seeing that it costs about 2s. 6d. per day to feed an infant, the method is beyond the means of a large class. The prescription on p. 53 is taken from Rotch's work (p. 257), and illustrates the method very well.

The prescription is placed in the hands of the modifying clerk, who combines the different elements of it by means of the elemental materials which have been brought into the modifying-room from a different part of the laboratory.

Home Modification of Milk.—The great advantages of milk laboratories are not within the reach of many; indeed, they have not been established in this country yet, except to a very small extent, and Dr. Rotch has devised a method for the modification of milk in the home which is so valuable that no apology is needed for reproducing it. Materials required: Sterilizer (an ordinary tin can will do quite well, the lid of which is perforated to admit a thermometer), a wide-mouthed glass quart jar, a siphon of glass tubing $\frac{1}{4}$ to $\frac{1}{2}$ inch in diameter, and bent so that the end out of which the milk is to flow is 6 inches longer than that which is inserted in the jar. One quart of fresh milk is thoroughly strained and put in the jar. The mouth of the jar is kept open for about fifteen minutes, to get rid of the animal heat. The jar is then sealed tightly, as in preserving, and is placed in a vessel containing ice-water and salt, in the proportion of a teaspoonful of salt to a quart of water, and set aside in a cool place for six hours. At the end of this period siphon out from the bottom of the jar three-quarters of the milk into a clean vessel. To start the siphon, fill it with boiled water, close the longer end with the finger, invert the siphon, and place the shorter end

in the milk. Then withdraw the finger, and the water, followed by the milk, will run out of the long arm of the siphon. Do not use the mouth to start the flow of milk through the siphon under any circumstances. You will now have the various materials ready for any combinations you may wish to make. The materials are: The milk portion siphoned from the jar; the cream portion remaining in the jar, and which contains 10 per cent. fat; milk-sugar, which may be ordered from a chemist, a pound being divided into thirty-five packages containing $3\frac{3}{8}$ drachms (200 grains) in each; fresh lime-water and some clean drinking water which has been boiled for five minutes. To prepare mixtures with definite percentages of proteid, fat, and sugar, the materials are mixed in the proportions given in the following tables. The milk-sugar should be thoroughly dissolved in the water of the mixture before the other materials are added.

TABLE A.

Proteids ...	... 0·25	Cream ...	½ ounce.
Fat ...	... 0·25	Milk ...	1 „
Sugar ...	... 4·00	Lime-water	1 „
Lime-water	... 5·00	Water ...	17½ ounces.
			20 „
		Milk-sugar...	2 packages.

A small tin measure may be obtained to hold $3\frac{3}{8}$ drachms, which would obviate the necessity of putting up in packages.

TABLE B.

Proteids ...	... 0·75	Cream ...	2 ounces.
Fat ...	... 1·00	Milk ...	2 „
Sugar ...	... 5·00	Lime-water	1 ounce.
Lime-water	... 5·00	Water ...	15 ounces.
			20 „
		Milk-sugar...	2 measures.

TABLE C.

Proteids ...	... 0·75	Cream ...	4 ounces.
Fat ...	... 2·00	Milk ...	none.
Sugar ...	... 5·00	Lime-water	1 ounce.
Lime-water	... 5·00	Water ...	15 ounces.
			20 „
		Milk-sugar ...	2 measures.

TABLE D.

Proteids ...	... 1·00	Cream ...	4 ounces.
Fat ...	... 2·00	Milk ...	1½ „
Sugar ...	... 5·50	Lime-water ...	1 ounce.
Lime-water	... 5·00	Water ...	13½ ounces.
			20 „
		Milk-sugar ...	2¼ measures.

TABLE E.

Proteids	... 1·00	Cream ...	5 ounces.
Fat ...	... 2·50	Milk ...	none.
Sugar ...	... 6·00	Lime-water ...	1 ounce.
Lime-water	... 5·00	Water ...	14 ounces.
			20 „
		Milk-sugar ...	2½ measures.

TABLE F.

Proteids	... 1·50	Cream ...	7 ounces.
Fat ...	... 3·50	Milk ...	1 ounce.
Sugar ...	... 6·50	Lime-water ...	1 „
Lime-water	... 5·00	Water ...	11 ounces.
			20 „
		Milk-sugar ...	2½ measures.

TABLE G.

Proteids	...	1·50	Cream	...	8 ounces.
Fat ...	...	4·00	Milk	...	none.
Sugar ...	...	7·00	Lime-water	...	1 ounce
Lime-water	...	5·00	Water	...	11 ounces.
					20 „
			Milk-sugar	...	$2\frac{3}{4}$ measures.

TABLE H.

Proteids	...	2·00	Cream	...	8 ounces.
Fat ...	...	4·00	Milk	...	$2\frac{1}{2}$ „
Sugar ...	...	7·00	Lime-water	...	1 ounce.
Lime-water	...	5·00	Water	...	$8\frac{1}{2}$ ounces.
					20 „
			Milk-sugar	...	$2\frac{1}{2}$ measures.

TABLE I.

Proteids	...	2·50	Cream	...	8 ounces.
Fat ...	...	4·00	Milk	...	5 „
Sugar ...	...	7·00	Lime-water	...	1 ounce.
Lime-water	...	5·00	Water	...	6 ounces.
					20 „
			Milk-sugar	...	$2\frac{1}{4}$ measures.

TABLE J.

Proteids	...	3·00	Cream	...	8 ounces.
Fat ...	...	4·00	Milk	...	$7\frac{1}{2}$ „
Sugar ...	...	7·00	Lime-water	...	1 ounce.
Lime water	...	5·00	Water	...	$3\frac{1}{2}$ ounces.
					20 „
			Milk-sugar	...	2 measures.

TABLE K.

For Weaning.

Proteids	...	3·00	Cream	...	8 ounces.
Fat ...	...	4·00	Milk	...	7½ „
Sugar ...	...	5·00	Lime-water	...	1 ounce.
Lime-water	...	5·00	Water	...	3½ ounces.
					20 „
			Milk-sugar	...	1 measure.

TABLE L.

For Weaning.

Proteids	...	3·25	Cream	...	8 ounces.
Fat ...	...	4·00	Milk	...	8 „
Sugar ...	...	5·00	Lime-water	...	1 ounce.
Lime-water	...	5·00	Water	...	3 ounces.
					20 „
			Milk-sugar	...	⅞ measure.

TABLE M.

For Weaning.

Proteids	...	3·50	Cream	...	8 ounces.
Fat ...	...	4·00	Milk	...	12 „
Sugar ...	...	4·50			
					20 „

Glass tubes, varying in number according to the number of feedings which are required in twenty-four hours, are charged with the requisite quantity of food. They are stoppered with sterilized cotton-wool, and the tubes are then placed in a rack and lowered into the sterilizer, the water in the sterilizer being adjusted to the level of the milk in the tubes. Heat by means of a lamp or stove is then applied to the sterilizer, which is watched, with the cover off, until the thermometer shows that the water-bath has reached a point of 171° F. The lamp is removed as soon as this temperature is reached, the cover is put in place, and a cosy over it. The thermometer should mark a temperature of between 167° F. and 170° F. for thirty minutes, at the expiration of which time the

tubes are to be removed from the sterilizer, and are to be kept in a cool place, preferably an ice-chest, until needed.

The Quantity of Food to be given.—As one might expect, this varies considerably in different children, and allowance must be made for large and strong or small and weakly infants. The tendency undoubtedly is to overfeed babies both as to quantity and quality, and the only reliable indication that the food which the child is taking is suitable for its requirements is a steady gain in weight. The child which sleeps most of the time and requires to be wakened for its bottle will not need as much food as the one which sleeps little and is active. For the first week after birth 1½ ounces at each feeding is sufficient; from the second week till the end of the first month 2 ounces; during the second and third months 3 or 4 ounces, according to circumstances; and from this date till the ninth month 6 to 8 ounces may be given if the child is strong and vigorous and does not appear satisfied with the lesser quantity.

The Number of Feedings in the Twenty-four Hours.—The child should be fed *regularly* every two hours during the first month from six in the morning till eleven at night. During the second month the time is extended to every two and a half hours. During the third month, and from this till the ninth month, it should be fed every three hours. So important is regularity in feeding that the child, if asleep, should be awakened when the right time comes round for its bottle. These intervals need not be rigidly adhered to, so that if the child is gaining in weight, sleeping well, and digesting its food well, it may be fed less frequently. The following table shows the amounts and the intervals of feeding:

Time-Table for Artificial Feeding.

Age.	Amount of Each Feed.	Total Amount in 24 Hours.	Number of Feeds.	Intervals.
1st week	1½ oz.	15 oz.	10	2 hours
2nd to 4th week	2 oz.	20 oz.	10	2 ,,
3rd month	3 to 4 oz.	24 to 32 oz.	8	2½ ,,
4th to 9th month	6 to 8 oz.	36 to 48 oz.	6	3 ,,

CHAPTER VI

ARTIFICIAL FEEDING (continued)

Feeding of difficult cases—Feeding of premature infants—The incubator or brooder—Graduated mixtures—Gavage—Feeding-bottles.

Feeding of Difficult Cases.—While the great majority of infants can be successfully reared by following one or other of the plans already laid down, still, there remain a certain number who do not prosper, and these are the difficult cases. In some instances the infants are weakly from birth, or they may have recently passed through an illness, such as gastro-intestinal or bronchial catarrh; or, again, the difficulty may be accounted for by faulty hygienic surroundings. In the majority, however, it will be found that the condition is due to, or has been caused by, improper feeding, and once an infant's stomach has become deranged to such a degree that nearly everything taken into it is rejected, it will be found a very difficult task to set it right again. In the treatment of all such cases the first step is to remove, or counteract, the cause, and, therefore, careful inquiry should be made as to what form of food the child has been taking, how the food has been given, and at what intervals the child has been fed. It will generally be found that either too much or too little food has been given, that the intervals between the feedings have been too long or too short, or it may be the food has been given too hot or not hot enough. Another point of much importance is to see, and examine, for yourself the feeding-bottle and the nipple, for herein lies a fertile source of trouble which arises

from carelessness in not keeping them thoroughly clean. Then, again, the infant's napkins should be examined every day, for the character of the motions affords valuable information as to which element in the food is at fault. In many of these cases it will be found on inquiry that a certain food has been diluted to a considerable extent, and given in large quantity and at more frequent intervals, in the hope that it may be retained. Should this prove to be the case, success may follow a smaller quantity of a richer food given at less frequent intervals, and, speaking in a general way, in dealing with such cases the intervals between the feedings should be longer than in health, and a few spoonfuls of water, which has been boiled and rapidly cooled, should be given between the feedings. A very common error is the giving of farinaceous articles, such as cornflour, wheat or oat-flour, etc., to a child at too early an age, and improvement often speedily follows the withdrawal of these. In the case of an infant whose digestion is feeble or has become deranged, and who regurgitates its food, the fat should be reduced to 1·5, or even 1 per cent., when under six months old, and to 2 per cent. when over this age, and the proteids should be reduced to 0·50 per cent., or they should be predigested. With a return to normal conditions the food should be strengthened, but on very gradual lines.

The Feeding of Premature Infants.—All infants born before the end of 280 days are included under this head. Should the infant be only a couple of weeks premature, it may be fed on ordinary principles provided it be well-developed and weigh over 6 pounds. When they are born at an earlier period than this the difficulty of feeding becomes considerable, and this difficulty increases in proportion to the increase of prematurity. The employment of the **incubator** or **brooder** renders it possible to rear such infants with a fair prospect of success, especially in maternity hospitals, where the brooder is ready to hand, and the infant can be placed in it at once after birth. The best form of brooder is that invented by Rotch, and the following description of it is taken from his work, p. 399 *et seq.*:

'For the purposes of disinfection, and that it may not absorb micro-organisms or dirt of any kind, which in

wooden receptacles invariably cause a decided odour, it is made entirely of metal. It is supported on three wheels, two behind and one guiding wheel in front. The top of the brooder is about 3 feet from the floor; it is 2½ feet wide and 3 feet long. The body is made of copper; the walls are double and insulated on the outside to prevent radiation. The water used for heating circulates on all sides, and the infant is thus kept warm by direct radiation. The top of the brooder is covered in the middle by a thick plate-glass lid, which can be raised sufficiently to allow the hands and arms of the nurse to be freely used in the brooder. On the under side of the glass lid is a fine wire sliding screen which comes directly over the infant's head and between it and the glass. This is a precaution against the possible breakage of the glass lid, and consequent injury to the infant. Air is admitted by means of a fan worked by clockwork, and below the opening for the fresh air is a window through which the proper working of the fan and the clockwork can be watched. Just below the air-opening and above the clockwork is a fine open wire shelf, upon which is spread a thin layer of cotton-wool, through which the air is filtered before it enters the brooder. The bottom of the brooder constitutes an air-chamber, and in this is a boiler which, with its heating and return flues, warms the interior of the apparatus. Above the boiler is placed the platform of a scale, which acts as a support for a metal pan 2 feet long and 1 foot wide, on which the infant is placed. This pan should be made of sheet-iron enamelled on both sides, and should have handles at either end to facilitate its removal from the brooder. From the ends of this pan is hung by wires a light frame made of four steel rods crossed, and which can be easily attached or detached. On this frame is tied with tapes a strong cotton cloth, which is the infant's bed, and on which it is placed wrapped in clean absorbent cotton. The infant's head is turned towards the back end of the brooder. At the front end is the exit for the vitiated air, which passes through the end of the brooder and enters a ventilating-pipe which has at its top an anemometer. The bottom of this shaft is placed outside the brooder, and has a closed cone-shaped end, which is

enclosed in a metal box in such a way that a lamp can be placed under it. The heat from this lamp keeps the ventilating shaft hot, and thus aids the ventilation and heats the water in the boiler. A register-valve attached to the pipe can shut off the heat from the boiler when necessary, or the valve may be set so as to direct the flame partially on the boiler, thus placing its temperature completely under control. In virtue of the large amount of heating surface in this apparatus, it is found that a very small flame suffices to keep up the desired temperature, a small spirit-lamp being quite enough. The heating of the brooder varies as to time and degree, according to the atmosphere of the room where it has been standing. If the temperature of the room is 70° F., and the temperature of the water which is introduced into the boiler is 105° F., it will be found that after the cool air in the brooder has been displaced the temperature of the air in the brooder will, in about fifteen minutes, rise to 95° F., and will remain at this point for about half an hour. As soon as the temperature begins to fall, the spirit-lamp should be lighted, and as soon as the water in the boiler reaches a heat of 95° F. the lamp should be extinguished. By careful regulation of the lamp and regulating the fresh air by means of the register-valves, an intelligent nurse can keep the temperature of the brooder at whatever degree the physician orders. The thermometer should, in order to show accurately the temperature of the air which the infant is breathing, be placed beside it on the bed, as when attached to the lid it is influenced by changes of temperature in the room. If any difficulty arises from the temperature not responding quickly enough to the register-valves and lamp, it is well to draw off a little hot water and replace it by some cold water if it is desired to lower the temperature, while to raise the temperature the withdrawn water is replaced by hot water. The brooder requires that a trained nurse should be in constant attendance, who should frequently observe the infant through the glass lid, and be particular to notice that the anemometer is in constant motion.' Premature infants are under weight, and show a striking amount of muscular debility, so that they lie motionless and may be quite unable to suck. If a premature infant

is to be successfully reared, three indications must be fulfilled: (1) It must be provided with a sufficient quantity of suitable nourishment; (2) its bodily temperature must be maintained; and (3) it must be protected from exposure and shocks.

1. The first indication is best fulfilled by giving the infant the breast; but as it may be unable to draw the milk, this should be obtained for it by means of an exhauster, and given from a spoon or from a medicine-dropper. Failing this source of nourishment, the composition of the food should be the same as that for infants at term, but the amount of the proteids and the fat must be reduced. Rotch recommends the following prescriptions:*

TABLE XXXIV.

Mixtures for Premature Infants.

(*a*)		(*b*)	
Proteids ...	0·50 per cent.	Proteids ...	0·50 per cent.
Fat ...	1·00 „	Fat ...	1·50 „
Sugar ...	3·00 „	Sugar ...	4·00 „
Twenty-four meals, each of 4 c.c. (1 drachm). Heat to 75° C. (167° F.).		Twenty-four meals, each of 8 c.c. (2 drachms). Heat to 75° C. (167° F.).	
(*c*)		(*d*)	
Proteids ...	0·75 per cent.	Proteids ...	1·00 per cent.
Fat ...	1·50 „	Fat ...	2·00 „
Sugar ...	5·00 „	Sugar ...	5·50 „
Twenty-four meals, each of 12 c.c. (3 drachms). Heat to 75° C. (167° F.).		Twenty-four meals, each of 16 c.c. (4 drachms). Heat to 75° C. (167° F.).	

Prescription (*a*) is intended for an infant premature from the twenty-eighth to the thirty-sixth week. Should the infant be not satisfied, or if it is unusually large for its age, change in a few days to (*b*), and if it is over thirty-two weeks alter to (*c*) in a few days. If the infant is over thirty-six weeks, the mixture should, after forty-eight hours, be increased and strengthened to (*d*). In case the infant is unable to digest any

* 'Pediatrics,' p. 300.

of these mixtures, or if it does not increase in weight, then partial peptonization should be tried, or condensed milk and cream given. Sometimes under such circumstances success may be obtained by giving a whey and cream mixture. It should be remembered that the stomach of the premature infant is very small, and is in all probability emptied quickly, and as food is an absolute necessity, if the bodily heat is to be maintained, the intervals of feeding should be shorter than those required for the infant at term. It is, therefore, advisable to feed it regularly every hour. These mixtures are given by means of a suitable feeding-bottle, but it occasionally happens that the infant is so feeble that it is quite unable to draw the milk. It may then be spoon-fed, or the mixture given with a medicine-dropper. Should neither of these plans prove successful, then recourse must be had to **gavage**—that is, introducing the food into the stomach by means of an india-rubber tube. The milk by this method is passed slowly into the stomach, and care is necessary to avoid giving too much at a time, or giving it too quickly. Food introduced in this way is often retained when food taken in the ordinary way is vomited, the explanation offered being that irritation of the vagus and sympathetic, by the acts of swallowing, is avoided.

2. The maintenance of the bodily heat of these mites is scarcely less important than their feeding, and to accomplish this two methods are available, as follows: (*a*) The infant is wrapped in layers of cotton-wool, which must include the limbs as well as the body, and some clothes are applied loosely over all. It is then placed in a cradle and covered with a down quilt or with blankets; two or three hot-water bottles are placed near it under the quilt or blankets. The temperature of the room should be kept at or near 90° F. The infant should be disturbed as little as possible, and therefore the napkins should be changed as seldom as need be. (*b*) By using a hatching cradle or brooder. This, of course, affords much the best means of maintaining the bodily heat, but it is expensive to purchase and is not always at hand. It should form part of the equipment of every maternity hospital, and the one already described is the best. By using a brooder Villemin successfully reared an infant

born at five and a half months, and which weighed under 2 pounds, and Charpentier one which weighed 2 pounds and 5 ounces.

3. Premature infants should be protected as completely as possible from exposure to changes of temperature. They should also be shielded from shocks, such as may be produced by loud noises and flashes of light. It should especially be remembered that they must be very carefully handled, that they are disturbed as little as possible, and that the minimum of washing and changing of clothes and napkins is practised.

Feeding-Bottles.—The simpler the form of the feeding-bottle the better, and those having long india-rubber tubes and a profusion of lettering and figuring on their surfaces are to be avoided. The bottle with a tube to it is considered so pernicious in France that it has been condemned by the Academy of Medicine, and the name given to it in that country, 'the baby killer,' is abundantly justified. There are many excellent feeding-bottles to be had, and Allen and Hanbury's feeder is perhaps as good as any. Whatever form of bottle is used, it is of the utmost importance that it be kept clean and sweet. Immediately after being used the bottle should be rinsed out thoroughly with hot water, this should be followed by a good rinsing with more hot water to which has been added one teaspoonful of baking soda; it is then left in a basin and covered with cold water to which one teaspoonful of boracic acid is added. Before using the bottle again rinse it out with water which has been boiled. The teat should be turned inside out and treated in a similar way.

CHAPTER VII

STERILIZATION OF MILK

Sterilization of milk—Bacteria in milk—Pathogenicity of bacteria in milk—Pasteurization of milk—The objections to sterilization.

It has been seen, in speaking of human milk, that, as the child draws it from the breast, it is sterile—that is, it is free from pathogenic microbes. When we come, however, to examine cow's milk, we find that, by the time it reaches the consumer in any large town or city, it is swarming with bacteria of different kinds. Many of these bacteria are no doubt harmless, and may be ignored; but as milk has been proved to be the medium of conveying the germs of tuberculosis, of typhoid fever, of diphtheria, of scarlet fever, to mention only a few, it becomes in the highest sense important to consider the means we have at our disposal of preventing the germs getting into the milk, or, if they are already in the milk, how they may be rendered harmless.

Conditions which influence the Number of Bacteria in Milk.—Freshly-drawn milk contains certain germicidal substances which under favourable circumstances—that is to say, when the milk is kept cool and free from gross contamination—will check the development of bacteria, and even sometimes diminish their numbers. When the milk is kept at a temperature of 50° F., the power of the germicidal substances becomes quickly exhausted. It would seem that the bacteria which collect on the teats in the intervals between the milkings make their way into the milk-ducts, and are washed out at the beginning of each

milking ; and Rotch, by employing minute antiseptic precautions, has demonstrated that the milk drawn may be absolutely sterile after the udder has been half emptied. From this we see how little the cow is to blame, but that the presence of the bacteria is due to want of cleanliness of the hands of the milker, of the vessels into which the milk is received, and by want of care in protecting the milk from contamination by dust, etc. The following table is taken from a paper by Dr. W. Hallock Park, of New York, and is very instructive :

TABLE XXXV.

Table showing the Number of Bacteria in 1 c.c. (17 drops) of Milk under Various Conditions of Milking and Handling.

Conditions of Milking and Treatment of Milk.	Number of Bacteria.		
	At or shortly after milking.	After 24 hours.	After 48 hours.
A. Scrupulous cleanliness :			
Kept at 45° F.	4,333	2,766	10,583
Kept at 45° to 50° F. ..	4,550	4,500	—
B. Cleanliness :			
Winter. Cooled to 45° F. within two hours ..	15,500	21,666	76,000
C. Cows dirty :			
Milk cooled to 45° F. within two hours —			
Winter	16,650	31,000	210,000
Summer	30,366	48,000	680,000
On arrival at New York Railway Terminus, 45° F. (average)	..	5,669,850	
As retailed, mid-winter :			
Tenement houses .. .		1,977,692	
Well-to-do houses		327,500	
As retailed, September :			
Tenement houses .. .		15,163,600	
Well-to-do houses		1,061,400	

In commenting upon his experiments, Dr. Park says : 'With only moderate cleanliness, such as can be employed

by any farmer—namely, clean pails, straining-cloths, cans or bottles, and hands, a fairly clean place for milking, and a decent condition of the cow's udder and the adjacent belly—milk when first drawn will not average in hot weather over 30,000, and in cold weather not over 25,000, bacteria per c.c. Such milk, if cooled to, and kept at, 50° F., will not contain at the end of twenty-four hours over 100,000 bacteria per c.c. If kept at 40° F., the number of bacteria will not be over 100,000 after forty-eight hours If, however, the hands, cattle and barns are filthy, and the pails are not clean, the milk obtained under these conditions will, when taken from the pail, contain very large numbers of bacteria, even up to 1,000,000 or more per c.c.'

In New York, milk purchased in ordinary shops averages in the coldest weather over 300,000; in cool weather about 1,000,000; and in hot weather about 5,000,000 per c.c. The lessons to be drawn from these facts are too obvious to require any comment.

Pathogenicity of Bacteria in Milk.—One of the greatest dangers arising from the use of milk is the conveyance of tuberculosis, and that the disease of consumption can be spread through this channel has been demonstrated beyond all doubt. The following conclusions were arrived at by Sims Woodhead and Sidney Martin as the result of recent experiments:

1. The milk of tuberculous cows **is only infective when it comes from a tuberculous udder.**
2. The udder affection may occur in slight cases of tuberculosis; it is not peculiar to the advanced stages.
3. Even if only one quarter of the udder is infected, the milk is very virulent.
4. Butter-milk, skimmed milk, and butter from a cow with a tuberculous udder are actively infectious.
5. The udder affection may develop with extreme rapidity.
6. Boiling is essential for the destruction of the bacillus in the milk.

From these conclusions, it is evident that all milk from a cow suffering from tuberculous disease of the udder, no matter how slight, must be destroyed. It is of the first importance, therefore, that all dairy cows should be sub-

jected to a weekly inspection by a competent veterinary surgeon. The tuberculous affection of the udder shows itself in the form of a slow, painless growth or nodule, which may arise on any part of the gland or on the teats. Should the least suspicion of udder disease make its appearance, it is advisable to destroy the milk, whether that disease proves to be tuberculous or not, and, apart from any affection of the udder, the milk of a cow suffering from any other form of tuberculous disease should not be used. The tuberculin test is the most reliable means of detecting the disease, and all dairy cows should be subjected to it and show no reaction.

The germs of the diseases mentioned already—that is, typhoid fever, diphtheria, and scarlet fever—may be conveyed in milk, the germs reaching it in the process of transit from the dairy to the consumer, or in other obvious ways, and many epidemics of these diseases have been clearly traced to the milk-supply.

One other affection deserves special mention here in connection with milk, and that is epidemic summer diarrhœa, to the ravages of which is due the appalling death-rate amongst infants and children during the summer months. The death-rate from this affection amongst infants under one year per million living was, according to the last decennial supplement to the Report of the Registrar-General for England and Wales, 16,044. These statistics show only the direct consequences of this affection, but there can be no doubt that its indirect effect upon the death-rate is very considerable when we bear in mind the condition of general debility and impaired nutrition which is left behind, and which makes the sufferer more prone to succumb to any subsequent complaint. The mortality from epidemic diarrhœa is highest in the summer months, and has been shown to follow very closely the rise in the temperature of the soil. That the infection is contained in the milk used is very generally admitted, the germs of the disease reaching it in transit from the dairy to the consumer, but more especially during the storage of the milk in the houses of the poor. The bacilli, which are the cause of these murderous attacks of summer diarrhœa in children, belong to the colon group, of which the *Bacillus coli communis* of Escherich and the *Bacillus*

enteritidis, are the extreme types, and the presence of which are indicative of fæcal contamination. Many other forms of bacilli are found in milk, such as the *Bacillus acidi lactici* and the *Oïdium lactis*, which give rise to the souring of milk; the *Bacillus prodigiosus*, which turns the milk a red colour; the *Bacillus cyanogenus*, which gives it a blue colour; and the *Bacillus synxanthus*, which causes it to become yellow. In addition to these, pyogenic organisms, such as the *staphylococcus pyogenes aureus* and the streptococci, may be present in the milk of cows suffering from inflammatory affections of the teats or the udder.

The first indication, then, is to prevent as far as is possible any of these germs reaching the milk, and to this end the greatest care should be exercised in the milking of the cows, the teats and the udders being first thoroughly cleansed, the milkers' hands being sterilized, and the milk-pails rendered aseptic. The milk should be kept in a cool place, preferably a refrigerator, and protected by sterile cloths from contamination with dust, etc.

The second indication is to destroy the microbes already in the milk, which, as we have seen, are very numerous, especially in the hot months. This is accomplished by either **Pasteurization** or **Sterilization**, and is carried out as follows:

Pasteurization of Milk.—By this is meant raising the milk to a temperature of 70° C. (158° F.), and keeping it at this heat for at least half an hour. The milk is subsequently cooled rapidly. The process is best carried out by using a sterilizer, of which there are many kinds to be had, such as Soxhlet's, Hawksley's, Cathcart's, Rotch's, Amard's, or Warner's. This amount of exposure is sufficient to destroy the great majority of the bacilli found in milk, but it will not kill the spores, and as these spores are present only when the milk has been kept for some time, the importance of fresh milk becomes apparent. It is not safe to consider pasteurization sufficient to destroy the tubercle bacillus, nothing short of full sterilization being adequate for this purpose. Pasteurization produces no change on the taste of the milk, and its digestibility is little, if at all, impaired. Whether the antiscorbutic principle is interfered with or not is open

to question, but at most it is only so to a trifling degree.

Sterilization of Milk.—The simplest method of sterilization is by boiling the milk, which is placed in a saucepan and covered with a lid. The length of time during which the process is continued varies from ten minutes to half an hour, the former being quite sufficient to destroy all known pathogenic organisms, the latter being necessary only in cases where the milk has to be prepared for a lengthened period—*e.g.*, for a long voyage. A more accurate and scientific method of sterilizing is by using a sterilizer, but this is not within the means of everyone, and the method of boiling in a saucepan will do quite well.

The Objections to Sterilization.—When milk has been subjected to a high temperature for any length of time, it becomes bitter in taste, and of a light-brown colour, from the conversion of some of the sugar into caramel. It loses in proteid value owing to the coagulation of a portion of the albumin, which rises to the top as a scum. The lactalbumin is partially precipitated, while the casein is rendered less coagulable to the action of rennet. The fat emulsion is destroyed to a considerable extent, the fat globules coalescing into larger masses than normal. The organic phosphorus is converted into an inorganic phosphate; the lime salts are changed to a certain extent into insoluble compounds; and the citric acid is partially precipitated as calcium citrate. Recently Dr. Netter has drawn attention to the fact that prolonged heating diminishes the citric acid in milk, and he maintains that, as citric acid is essentially an antiscorbutic, its removal, or partial removal, causes or encourages scurvy. De Rothschild and Abramoff believe that there is a sort of auto-peptonization of the milk which is produced in the first stages of sterilization, before the temperature has become sufficiently high to destroy all the germs (see *British Medical Journal*, May 2, 1903, p. 1037). The antiscorbutic principle is very seriously affected, and probably wholly destroyed, as is proved by the well-known fact that infants fed on sterilized milk for a lengthened period become scorbutic. These are weighty objections which cannot be ignored, and in face of them sterilized

milk should not be given, as the sole nourishment, to a young child for longer than two months at a time. The advantages, however, of sterilization, when applied to the milk as used by the poor in large centres of population, are very great, and it should certainly be carried out during the summer months, at which time contamination with microbes is more likely to occur and bacterial growth is more rapid.

CHAPTER VIII

PEPTONIZED MILK, CONDENSED MILK, PROPRIETARY FOODS, ETC.

Peptonized milk: How prepared—Smith's method—Fairchild's process—Roberts' method—Indications for use of—Length of time it may be used. Condensed milk: Kinds of—Nutritive value of—Objections to use of. Ass's milk: Compared with human milk—Composition of. Mare's milk: As a substitute for human milk—Composition of. Goat's milk: Advantages of—Composition of. Koumiss and kephir: Modes of preparation—Composition of—Advantages of. Matzoon or zoolak: How prepared—Composition of. Proprietary foods: Different kinds of. Diet after weaning—Diet tables.

IT has been already shown that the main difficulty met with in feeding an infant with the milk of the cow is in the proteids which it contains, and especially in the large amount of casein present, which forms dense, tough masses of curd. Some methods by which this difficulty may be met have been put forward, and it now remains to consider the most efficient means at our disposal for dealing with it, and that is by peptonization.

Peptonized Milk.—This term is applied to milk in which the proteids have been converted, either partially or wholly, into peptones by the action of a substance which is known in the market as **extractum pancreatis**, the active ferment in which is **trypsin**. The peptonization of milk can be carried out in the home quite well, and any one of the following methods is suitable:

1. **Eustace Smith's Method.**—Add 5 grains of pure pepsin and four drops of dilute hydrochloric acid to each

ounce of milk; keep in a water-bath at a temperature of 100° F. until the mixture becomes clear. Neutralize by the addition of bicarbonate of soda, and the milk is ready for use. By this method all the proteid is converted into soluble peptone. Should a less complete peptonization be preferred, all that is necessary is to diminish the length of the heating, and on removing from the bath the mixture should be rapidly raised to the boiling-point, which stops any further action of the ferment.

2. **Fairchild's Process.**—One pint of fresh cow's milk and 4 ounces of water are put into a bottle, and one of Fairchild's zyminizing powders, containing 5 grains of pancreatic extract and 15 grains of bicarbonate of soda, is added, the whole being shaken up. This mixture is kept at a temperature of 105° to 115° F. by placing the bottle in hot water, and it should get a shake from time to time. By this means different degrees of peptonization can be obtained; the longer the heat is continued, the more of the proteid is converted into peptone, and the more bitter does the taste of the milk become. To completely convert all the proteids into peptones, the process must be continued for two hours; to convert half the proteids, for one hour, and so on. Milk which has been peptonized for ten minutes is not altered in taste, but a slight bitterness becomes apparent after the process is continued for twenty minutes. To arrest the action of the ferment at any stage in the process, the mixture is raised rapidly to the boiling-point, or the activity of the ferment may be stopped by placing the mixture on ice. Should the milk be intended for immediate use neither of these procedures is necessary.

Roberts' Method.—Add ½ pint of boiling water to 1 pint of fresh cow's milk; dissolve 20 grains of bicarbonate of soda in a little water, and mix this with two teaspoonfuls of Benger's Liquor Pancreaticus; mix the whole in a jug, cover it up, and keep it warm under a cosy for one hour. Pour out into a saucepan, and boil rapidly. Sweeten with sugar of milk.

By any of these methods milk mixtures can be predigested to any extent required, and as the difficulties of digestion are overcome the amount of peptonizing is gradually diminished. Peptonized milk is a valuable

resource in the rearing of premature infants, and for those whose powers of digestion are feeble, and, as has been already said, it is probably the best and safest substitute for human milk when artificial feeding has to be adopted from birth. It is also a very useful means of supplying nourishment during acute gastric or intestinal attacks in children. While it possesses these undoubted advantages, it must, however, be clearly understood that it is not suitable as a permanent diet for a healthy infant, because the continued use of a food which is already digested weakens the natural powers of the stomach, which becomes enfeebled by want of the exercise of its proper function. It is, therefore, unwise to continue the use of peptonized milk for a longer period than one month.

Condensed Milk.—This is a very popular and widely-used substitute for human or for cow's milk, 500,000 hundredweight of it being imported into this country every year. It is prepared by heating milk to the boiling-point and evaporating *in vacuo* to about a quarter of the original bulk. This process is supposed to destroy all micro-organisms which may be present, and it alters the casein so as to make it more digestible. The following account is taken from Hutchison's work on 'Food and Dietetics,' p. 442 *et seq.*

Three kinds of condensed milk are obtainable, as follows :

1. Unsweetened and condensed whole milk.
2. Sweetened and condensed whole milk.
3. Sweetened and condensed skim milk.

1. **Of the unsweetened condensed whole milks** there are four examples, which have the following composition :

TABLE XXXVI.

Brand.	Total Solids.	Proteids.	Fat.	Milk-Sugar.
Ideal ...	38·0	8·3	12·4	16·0
First Swiss...	36·7	9·7	10·5	14·2
Viking ...	34·2	9·0	10·0	13·3
Hollandin ...	43·0	11·3	9·8	18·5

If one part of such a milk is diluted with two parts of water, the resulting fluid corresponds more or less closely to a good sample of pure cow's milk.

2. **The sweetened condensed whole milks** contain, as a rule, rather more added cane-sugar than there are solids in the milk. The following is the composition of some of the best brands :

TABLE XXXVII.

Brand.	Total Solids.	Proteids.	Fat.	Milk-Sugar.	Cane-Sugar.
Nestlé's ...	77·2	9·7	13·7	15·0	37·2
Rose ...	76·6	8·3	12·4	17·6	36·1
Milkmaid ...	76·3	9·7	11·0	14·6	38·7
Full-weight	76·5	12·3	11·0	13·5	37·2
Anglo-Swiss	74·4	8·8	10·8	16·0	37·1

In consequence of the amount of cane-sugar which has been added, these milks require to be diluted with several times their bulk of water. This reduces the amount of fat and proteid much below what is present in cow's milk.

3. **The sweetened and condensed skim milks** are those most numerous on the market. They contain very little **fat**, and when diluted in the proportions recommended for infants the resulting fluid is very poor in proteids, and almost free from fat ; it is therefore entirely unsuited for a baby's nourishment and need not be further considered.

Nutritive Value and Digestibility of Condensed Milk.—Condensed milk is more easily digested than cow's milk, the explanation of this being that the casein undergoes some chemical change in the process of manufacture ; but it is deficient in the very essential element **—fat.**

The subjoined table shows the character of the liquid which is produced by following the directions on the labels of half a dozen of the best brands of sweetened whole-cream milk :

TABLE XXXVIII.

Sweetened Whole Milk.	Dilution recommended for Household Purposes.	Fat in such Product per Cent.	Dilution recommended for Infant's Use.	Fat in such Product per Cent.
A ...	1 to 3	2·6	1 to 5	1·8
B ...	1 „ 5	1·6	1 „ 14	0·7
C ...	1 „ 5	1·6	1 „ 14	0·6
D ...	1 „ 6	1·4	1 „ 15	0·7
E ...	1 „ 5	2·1	1 „ 14	0·8
F ...	1 „ 5	1·7	1 „ 14	0·7
G ...	1 „ 5	1·7	1 „ 14	0·7
Human Milk ...	—	—	—	3·5

This is a most instructive and important table, showing as it does, at a glance, the poverty of these milks in fat when diluted. Babies fed on them may look fat enough, and generally do, but they are anæmic and flabby, and have little power to resist any form of disease, such as attacks of gastro-enteritis or bronchitis. But the most constant effect of prolonged use of condensed milk is the production of rickets, and as the antiscorbutic principle is destroyed in the manufacture, scurvy is a frequent accompaniment. In giving a baby condensed milk, therefore, it must never be forgotten to add to the mixture some cream to supply the deficiency of fat, and a little orange or grape juice, given two or three times a week, will counteract the tendency to scurvy. Condensed milk is stated to be sterile, because of the high temperature to which it is subjected during its manufacture; but it is not always so, and it is advisable to sterilize it after dilution, and before giving it to the child. For the reasons stated – that is, because of the deficiency of fat and the large amount of cane-sugar present – this form of milk should not constitute the exclusive diet of a young baby for any lengthened period. As a temporary substitute, it may be given to infants while travelling, or when it is difficult to obtain a reliable milk-supply. It is also useful for weakly

infants, or for those suffering from gastro-enteric disturbance or in summer diarrhœa. Before passing from the consideration of milk, a short statement may be given regarding some other kinds of milk and preparations made from milk.

Ass's Milk.—This is often stated to be the nearest approximation to human milk; its composition is as follows:

TABLE XXXIX.

Ass's Milk.		Human Milk.	
Proteids ...	1·90 per cent.	Proteids ...	1·52 per cent.
Fat ...	1·40 „	Fat ...	3·50 „
Sugar ...	6·30 „	Sugar ...	6·50 „
Salts ...	0·40 „	Salts ...	0·27 „

From the above analysis, it will be seen that ass's milk is poor in the important element of fat. It contains relatively more casein and less lactalbumin than human milk and it is laxative, sometimes considerably so, in its action. It is, moreover, expensive and difficult to obtain. Ass's milk may be useful as a temporary food, but it should not be given for any lengthened period.

Mare's Milk.—This is sometimes recommended as a substitute for the breast in the first instance. It approaches very closely to ass's milk in composition, and may be used like it as a temporary food. Mare's milk is poor in fat, and it is difficult to obtain. The following is its composition:

TABLE XL.

	Mare's Milk.
Proteids	2·30
Fat	1·90
Sugar	5·10
Salts	0·50

Goat's Milk.—This is a strong milk in every ingredient, and therefore it requires to be more freely diluted than cow's milk before it is given to a young infant. It has a peculiar, and to many a disagreeable, odour, which, however, disappears on boiling. It is popularly believed

to be more digestible and more nutritious than cow's milk, and this belief is, to a small extent, well founded. One advantage may be claimed for it over cow's milk, namely, that there is much less liability to the transmission of tuberculosis by its use, the goat being practically immune against this disease. The following table shows the composition of it:

TABLE XLI.

Goat's Milk.

Proteids	Casein	3·40
	Lactalbumin	1·30
Fat		4·36
Sugar		4·00
Salts		0·62

Koumiss and Kephir.—**Koumiss** is a preparation of great antiquity, and is largely used by the Tartars and other tribes of the south-eastern steppe country of Russia. The original koumiss was made from mare's milk by acting on it with kephir grains.

Kephir is a modern substitute for koumiss, and is prepared from the milk of the cow. The process now most commonly employed in making kephir is as follows: 1 quart of fresh whole cow's milk is mixed with 2 ounces of water, ½ ounce of sugar, and a piece of fresh yeast cake ½ inch square: this mixture is put in wired bottles, and kept at a temperature of between 60° and 70° F. for one week; it should be shaken up frequently, and at the end of this time put upon ice when it is ready for use.

Sakovich prepares it by mixing together ½ pint each of whole fresh cow's milk and water with 15 grains of fresh yeast. To this is added 1 ounce of finely-powdered white sugar, the whole being poured into a champagne bottle and exposed for twenty-four hours to a temperature of between 60° and 70° F. After this it is carefully corked and tied down, and placed in a cool cellar for five days, at the end of which time it is ready for use. As thus manufactured, kephir contains alcohol, carbon dioxide, and lactic acid. The casein is partly precipitated in a state of fine division, and partly predigested and

dissolved, while the fat and the salts are left much as they were. The following table shows the approximate composition :

TABLE XLII.

	Proteids.	Sugar.	Fat.	Salts.	Alcohol.	Lactic Acid.
Koumiss -	2·2	1·5	1·90	0·9	1·7	0·9
Kephir -	3·1	1·6	2·0	·0·8	2·1	0·8
Mare's milk	2·30	5·10	1·90	0·5	—	—
Cow's milk -	3·50	4·8	3·60	0·7	—	—

Kephir is almost identical in composition with genuine koumiss, but, being made from cow's milk, it is richer in casein, and is therefore the stronger and better preparation. In appearance it resembles butter-milk, being thick but not lumpy, and it is less acid. It is nutritious and easily assimilated, and it has a laxative and mildly diuretic action. For infants under one month it should be diluted with one third water, but after the second month it may be given undiluted. It is a very valuable resource in many forms of acute or chronic indigestion, or during attacks of diarrhœa, being often retained when milk in any other form is rejected. When the stomach is very irritable it should be given cold, and in small quantities, at frequent intervals, such as one tablespoonful every half-hour or so. It may now be obtained from most of the large dairy companies, a large champagne bottle-full costing about 1s.

Matzoon.—Matzoon or zoolak is a fermented milk which is extensively used by the natives of Asia Minor. It is made from cow's milk, which is first boiled for half an hour for the purpose of sterilization. A ferment is added, and the milk is kept at a temperature of 105° F. for twelve hours in an open vessel, the temperature being gradually allowed to fall till about 70° F. is reached, when it is bottled and kept on ice. Matzoon is a thick, curdy fluid with a taste like sour cream. For infants it should be diluted half and half with water, and given with a spoon,

as it is too thick to pass through a feeding-bottle. The following table shows its composition:

TABLE XLIII.

Matzoon or Zoolak.

Proteids	3·48
Fat	3·49
Milk-sugar	3·68
Lactic acid	0·90
Alcohol and other products of fermentation	0·13
Mineral salts	0·69

The changes in the proteids are much the same as those in koumiss and kephir, and it may be used in the same way and under similar circumstances.

Proprietary Foods.

The number of these foods and preparations on the market is enormous, and undoubtedly they are bought and used by the public in very large quantities. The descriptions published about them, and the advantages to be derived from their use, are put forth in no uncertain way, and so we find some of them described as 'the best food for infants,' or, again, they are spoken of as 'a perfect substitute for mother's milk.' It therefore becomes very important to inquire into the composition of these foods, with the object of finding out how far such claims are justified. Many of them contain a large quantity of carbohydrates, usually in the form of starch, and some, a considerable amount of cane-sugar. Malt diastase, or some such ferment, is freely used to convert a portion of the starch into dextrin and maltose. To facilitate the consideration of them, they are divided into three groups, and their nutritive value is compared with that of dried human milk. The following account is compiled partly from the *Pharmaceutical Journal* of February 28, 1903, in which is published an abstract from an address delivered by Dr. Hutchison before the South-West London Medical Society, and partly from other sources.

Group I.—This group contains those foods which are intended to be complete substitutes for human milk, and on which a child may be successfully reared without

further addition. They are, practically speaking, desiccated milks—milks, that is to say, from which all the water has been driven off, whilst other constituents have been added. It is possible to rear children healthily on these foods, though they are deficient in fat, and, as I have endeavoured to emphasize before, let me say once again, this is a serious deficiency which can, however, be supplied by the addition of cream. But the great drawback in regard to these foods is their cost. It is vastly more expensive to feed a child upon one of them than upon fresh or even condensed milk.

Group II.—This group contains the malted foods, and the starchy foods, in which the starch is supposed to have been altered by the action of a ferment. Infants below six months old are not expected to digest starch, and these foods have been introduced to overcome this difficulty. They are supposed either to contain no starch at all, or the starch which they do contain undergoes conversion into dextrin and sugar in course of preparation for the use of the child. The first of these classes is exemplified by a food which contains no starch at all, and is marked in the table which follows as Class A. It may be regarded, for practical purposes, as simply a desiccated malt extract, and it bears to malt extract very much the same relation that some of the foods of the first group do to condensed milk. It is only intended to be an addition to milk. In the other class of this group, and marked Class B in the table—namely, the foods in which the starch is converted during mixing—it will often be found that the starch has undergone anything but complete transformation.

Group III.—This group is composed of those foods which make no pretence of being malted at all—they are starchy foods pure and simple. In some they have been baked, so that the starch grains have been ruptured; but otherwise they are floury preparations, and while many of them are harmless to children who are able to digest starch—although there may be some use in them in the way of a change—yet they have no real advantage over ordinary simple preparations, such as baked flour or any other ordinary cereal preparations. For children under the age of six months they are altogether unsuitable.

TABLE XLIV.

Showing the Composition of Infant Foods.

Food.	Proteid per Cent.	Fat per Cent.	Carbo-hydrate per Cent.	Mineral Matter per Cent.	General Description and Remarks.
Dried Human Milk.	12·2	26·4	52·4	2·1	The standard of composition to which artificial substances should conform.
GROUP I. **Allenburys No. 1**—for children below the age of three months.	9·7	14·0	66 85	3 75	Desiccated cow's milk from which the excess of casein has been removed, and a certain proportion of soluble vegetable albumin, milk, sugar, and cream added No starch present. Half an ounce in 3 ounces of water for a child aged three months.
Allenburys No. 2—for children from the age of three to six months.	9·2	12·3	72·1	3·50	Resembles the above, but contains some malted flour in addition. No starch present. One ounce in 6 ounces of water for child aged six months.
Horlick's Malted Milk.	21·8	8 40	63·5	3·9	A mixture of desiccated milk (50 per cent.), wheat flour (26¼ per cent.), barley malt (23 per cent.), and bicarbonate of soda (¾ per cent.). Contains

TABLE XLIV.—*continued.*

Food.	Proteid per Cent.	Fat per Cent.	Carbo-hydrate per Cent.	Mineral Matter per Cent.	General Description and Remarks.
Horlick's Malted Milk—*continued.*					no unaltered starch when mixed. Three teaspoonfuls (= 22 grammes) in 4 ounces of water for a child aged three months.
Carnrick's Soluble Food.	13·6	2·5	76·2	2·20	A mixture of desiccated milk (37½ per cent.), malted wheat flour (37½ per cent.), and milk-sugar (25 per cent.). When prepared according to directions, the casein is partly digested, but a considerable amount of unchanged starch is left. One part is to be mixed with 9 parts of water, and boiled for a few minutes.
Nestlé's Milk Food.	11·0	4·8	77·4	1·30	A mixture of desiccated Swiss milk, baked wheat flour, and cane-sugar (30 per cent.). But by careful preparation of the food this starch becomes converted into dextrin. One ounce to be mixed with 5 ounces of water.
Manh.. Infant Food.	8·7	5·6	75·9	1·00	A mixture of desiccated milk and malted cereals. When prepared accord-

					ing to directions, it contains a good deal of unconverted starch, which however is reduced to a minimum by careful cooking. A dessert-spoonful (=13 grammes) to be mixed with 2½ ounces of water.
GROUP II.—*Class A.*					
Mellin's Food.	7·9	Trace	82·0	3·80	A completely malted food. All the carbohydrate in a soluble form. May be regarded as a desiccated malt extract. Half a tablespoonful (about 5 grammes), ¼ pint of fresh milk, and ¼ pint of water for a child under the age of three months.
Class B.					
Savory and Moore's Food.	10·3	1·4	83·2	0·60	Composed of wheat flour with the addition of malt. When prepared according to the directions, most, but not all, of the starch is converted into soluble forms (chiefly dextrins). One or two tablespoonfuls (=from 1 ounce to 2 ounces) to be mixed with two or three tablespoonfuls of cold milk, or milk and water, and ⅓ pint of boiling milk.
Benger's Food.	10·2	1·2	79·5	0·80	A mixture of wheat flour and pancreatic extract. When prepared accord-

TABLE XLIV.—*continued.*

Food.	Proteid per Cent.	Fat per Cent.	Carbo-hydrate per Cent.	Mineral Matter per Cent.	General Description and Remarks.
Benger's Food — *continued.*					ing to directions, most, but not all, of the starch is converted into soluble forms. The proteid is also partially digested, as well as that of the milk used in mixing it. One tablespoonful (about ¾ ounce) and four tablespoonfuls of cold milk, then add ½ pint of boiling milk and water, set aside for fifteen minutes, then bring to the boil.
Allenbury's Malted Food.	9·2	1·0	82·8	0·50	A mixture of wheat flour and malt. When prepared according to the directions, it still contains some unaltered starch. Designed for children above the age of six months. One tablespoonful (about 1 ounce), a teaspoonful of sugar, and three tablespoonfuls of cold water; mix, and add ½ pint of boiling milk and water (equal parts).
Maltova.	14·1	5·2	76·9	2·8	This is a malt extract in combination with a concentrated preparation of fresh eggs. It readily transforms starch

					into sugar, and the quantity of albumen, vitellin, nuclein, and salts which it contains, renders it a very nutritious food, and one well calculated to supply the wants of the growing organism.
Diastased Farina.	7·6	1·3	81·7	1·10	A malted farinaceous food. When prepared according to directions, practically all the starch is converted into soluble forms. One ounce of food, ½ pint of cold milk, and 2 ounces of water. Heat slowly until it boils; boil for three minutes, and sweeten if desired.
Coombs' Malted Food.	12·1	2·8	76·8	0 40	A malted farinaceous food. When prepared according to the directions, it still contains much unaltered starch.
Nutrea Food.	15·9	10·3	66·0	1·00	A mixture of cereals with the addition of a certain proportion of peanut flour, from which the somewhat bitter taste of the food, and its high proportion of fat, are derived. It is a self-digesting food, but when prepared according to the directions, only part of the starch is converted One ounce of the food to be mixed with 1 ounce of cold

TABLE XLIV.—*continued.*

Food.	Proteid per Cent.	Fat per Cent.	Carbo-hydrate per Cent.	Mineral Matter per Cent.	General Description and Remarks.
Nutroa Food—*continued.*					water, and ½ pint of boiling milk and water (equal parts) to be added.
GROUP III.					
Ridge's Food.	9·2	1·0	81·2	0·70	A baked flour containing only 3 per cent. of soluble carbohydrates, the remainder being starch. Recommended to be made with milk or water. Made with water alone it forms a totally insufficient food.
Neave's Food.	10·5	1·0	80·4	1·60	Resembles the above, but is recommended to be made with milk and water.
Opmus Food.	9·1	1·0	78·6	0·40	A granulated wheat food. One teaspoonful to ½ pint of milk. Starch unaltered.
Falona.	8·4	3·5	79·9	1·20	A mixture of cereals (oats, barley, and wheat) with a ground fat-containing bean. The food is thoroughly baked, but contains a considerable proportion of unaltered starch. A teaspoonful to ½ pint of boiling milk or water, or half milk and half water.

Robinson's Groats.	11·3	1·6	75·0	1·70	Ground oats from which the husk has been removed. Rich in proteid and mineral matter.
Robinson's Patent Barley.	5·1	0·9	82·0	1·90	Ground pearl barley, poor in every element except starch and mineral matter.
Chapman's Whole Flour.	9·4	2·0	79·3	0·90	A finely ground whole wheat flour. Not much superior in nutritive value to ordinary 'household' flour. Starch entirely unaltered.
Scott's Oat Flour.	9·7	5·0	78·2	1·30	A fine oat flour. Somewhat inferior in nutritive value to 'groats.' Starch unaltered.
Force.	11·9	0·76	75·95	2·68	A preparation of wheat and barley malt. It is rich in proteids, but very poor in fat. It should be given with milk and cream.
Paget's Milk Food.	1·33 to 2·0	3·5 to 4·0	6·5 to 7·0	0·27	This is a modified, fresh, whole cow's milk. It is standardized and, therefore, by the proper addition of water, mixtures can be made to suit infants from birth onwards. It can be confidently recommended as a substitute for the breast, the analysis of it approximating very closely to that of human milk. It is rich in fat, and shows but little clotting on the addition of rennet.

Such, then, is the composition of a few of the infant foods, and little remains to be added to the statistics given in the table. One very important point, however, should not be forgotten, which is this, that not one of them possesses any of the antiscorbutic principle; and because of this deficiency the prolonged use of them is almost certain to result in the child becoming scorbutic. Dr. Cheadle has directed attention to this very forcibly when he says, that the proprietary foods, of all others, are the greatest sinners in this respect. He is also of opinion that scurvy is more frequently seen in the children of the well-to-do than in those of the humbler classes, because they can afford to buy these foods, and less frequently suckle their offspring. During their use for any lengthened period, it is, therefore, necessary to give the child some orange or grape juice two or three times a week.

Before leaving the subject of the artificial feeding of infants and children, there is one point to which I wish to refer, and that is the question of **variety in the food**. We know that the adult is accustomed to a change in his diet, not only from day to day, but during the same day, and unless this variety is supplied his appetite fails, and he ceases to take his food with a relish. That the same variety is sometimes necessary for the child need not be wondered at, and to avoid monotony it is, therefore, desirable to introduce some slight change in the form of the child's mixture from time to time. This can easily be done by using a whey and cream mixture one day, or by adding one teaspoonful of Mellin's food, which alters the taste of the milk, another day, and so on. I do not wish it to be understood, from these remarks, that when a young child is taking a certain form of mixture with apparent relish, and is making satisfactory progress under its use, that these suggested changes should be introduced merely as a matter of routine. On the contrary, such a procedure would be most unwise. But should the child show by certain symptoms that it does not care for what it is getting—for instance, if it does not finish its bottle, and becomes fretful and peevish—then, I think, a change, on the lines indicated, should be tried.

An example occurs to me in which I was consulted quite recently in the case of an infant where the united

efforts of two doctors and several nurses had failed to provide a food which it would take; but they had confined themselves to modifying Horlick's milk in varying proportions. On my suggestion a variety was tried, and by giving Mellin's food, a whey and cream mixture, and cow's milk properly diluted, at different times, complete success resulted. I am glad to find myself in accord on this point with so eminent an authority on the subject as Dr. Eustace Smith, who in the last edition of his splendid work on 'The Wasting Diseases of Children,' p. 42, says 'the question of variety in the feeding is a point little regarded as a rule, but which to his mind is one of extreme importance.'

The Diet after Weaning and during the Second Year.

The child should be weaned at the end of the ninth month, and the process completed in the course of the next month. For reasons already mentioned, weaning may be delayed, but the child should never be kept at the breast after the twelfth month. From the time at which weaning is commenced until the end of the first year the diet should be gradually changed from breast milk to modified cow's milk, and when this is accomplished some carbohydrate is added. It is important to bear in mind that for some time after weaning cow's milk should form the basis of the diet. From twelve to eighteen months five feedings in twenty-four hours are required, the interval between the feedings being about four hours, and the amount of food given from 40 to 50 ounces. Each feeding, therefore, will consist of from 8 to 10 ounces, of which milk forms four-fifths, and the other fifth some form of farinaceous food, thoroughly cooked, and then strained. The best vegetable proteid-yielders for children are oats (oat flour, groats, and rolled oats); wheat, such as whole wheat flour, semolina, or such patent wheat foods as Opmus or Florador. These may be supplemented at this time by giving yolk of egg and raw-meat juice on alternate days, not only on account of their high proteid value, but for their antiscorbutic power; or on alternate days a few ounces of mutton or chicken tea. Many other things may be given at this time, as may be seen by referring to

the following tables, which are reproduced from the work of Dr. Cautley (p. 286 *et seq.*):

TABLE XLV.

Diet from the Age of Twelve to Eighteen Months.

First Meal, at 6.0 to 7.0 a.m.:

Six ounces of boiled milk, hot or cold.

A slice of stale bread, or a rusk, broken up and soaked in the milk, or a slice of thin bread with dripping or butter.

Second Meal, at 8.30 to 9.30 a.m.—one of these daily:

A small basin of bread and milk.

A little fine oatmeal porridge with cream or milk.

A basin of thick milk gruel.

A cup of cocoa made with milk, and a little thin bread-and-butter.

Third Meal, at 1.0 p.m.:

First Course—one of the following:

Mashed baked old potato moistened with milk, beef-tea, broth, soup, or the red gravy of under-cooked meat.

Lightly boiled or poached yolk of egg mixed with stale bread-crumbs, or mashed potato and gravy.

Stale bread-crumbs soaked in beef-tea, broth, or soup.

Second Course—one of the following:

A large tablespoonful of custard, tapioca, cornflour, ground rice, or semolina pudding, blanc-mange, or junket.

Cold boiled water, or milk and water, to drink.

Fourth Meal, at 5.0 p.m.:

The same as the first meal, or thin cocoa and bread-and-butter.

Fifth Meal, at 9.0 p.m.:

A large cupful of milk gruel made with rice, sago, tapioca, or hominy, or a rusk or sponge-cake soaked in milk.

Any other things of the nature of those mentioned above may be given, and the diet thereby varied

from day to day; and, in the case of a strong, healthy child, small quantities of fish, chicken, or underdone meat may occasionally be added. During the next period, which includes the time from the eighteenth month up to the complete eruption of the milk-teeth—that is, to the end of two or two and a half years of age—the diet should be strengthened by allowing more meat, fish, and vegetables, and fruit may be added.

Diet from the Age of Eighteen to Thirty Months.

First Meal, at 6.30 to 7.30 a.m.:

A large cupful of milk with rusk, stale bread or milk biscuit broken up and soaked in it, or some bread-and-butter.

Second Meal, at 8.30 to 9.30 a.m.—one of the following:

A basin of bread and milk.

Oatmeal porridge with milk, cream, or golden syrup.

A basin of hominy grits and milk.

Boiled milk or cocoa with bread-and-butter.

Boiled milk, a lightly-boiled egg, and bread-and-butter.

Third Meal, at 1.0 p.m.:

First Course—one of the following:

Mutton, undercooked beef, chicken, turkey, or fish, minced finely, pounded up for the younger children in a mortar into a paste. One tablespoonful of one of these mixed with mashed old potato, or stale bread-crumb and gravy.

Lightly boiled or poached egg with mashed potato or stale bread-crumb and gravy.

A large cupful of broth, soup, or beef-tea, with mashed potato or stale bread-crumb.

Second Course—one of the following:

Custard or plain milk pudding, blanc-mange, corn-flour or ground rice mould, plain sweetened jellies.

Fourth Meal, at 5.0 p.m.—one of the following:

A large cupful of milk, with bread-and-butter, rusks, milk biscuits, or sponge fingers.

A cup of thin cocoa, made with milk, and bread-and-butter.

A small basin of milk gruel or bread and milk.

Fifth Meal, at 9.0 p.m. (if the child wakes for it) :

A cup of boiled milk, and a biscuit or piece of bread soaked in it, or a cupful of milk gruel.

In addition to potatoes, such vegetables as spinach, broccoli, cabbage, or cauliflower, or well mashed turnips or carrots, may be given. The child should be taught to drink at meal-times only, except in very hot weather, and the best drink for it with meals is pure filtered water ; one of the aerated waters or a little lemonade may be allowed occasionally, but their daily use should not be encouraged. It is a very common practice to give children milk to drink at their dinner ; this is a mistake, and is frequently the cause of indigestion. No tea, coffee, beer, stout, wine, or other alcoholic stimulant, is permissible except under medical orders.

Diet after the Age of Two and a Half Years.

Breakfast, at 7.30 to 8.30 a.m. :

Either bread and milk, porridge with milk or golden syrup, or hominy grits and milk, bread with butter, dripping, or fruit jelly ; milk or cocoa to drink.

After the age of four :

Eggs lightly boiled, or poached, or scrambled, plain omelette, a little fat bacon or ham, a little fish or fresh potted meat, may be added to the diet.

Lunch, at 11 a.m. :

A cupful of milk or broth and a slice of bread-and-butter, or a plain biscuit.

Dinner, at 1 p.m., of two courses, selected from :

Minced beef, mutton, chicken, or turkey ; boiled fish ; poached egg ; mashed potatoes and pounded-up vegetables : macaroni ; milk puddings, blancmanges, farinaceous moulds, stewed fruit, jellies.

Tea, at 5 p.m. :

A basin of bread and milk, milk gruel, hominy and

milk, a cup of milk with bread-and-butter, biscuit, or bread and potted meat or fish ; fruit jellies may also be allowed.

Supper, at 9 p.m. (if required):

A cup of milk and a biscuit.

After the age of four the meat need not be minced, and from this time onwards the child may take its place at the table. It should be taught to masticate its food thoroughly, and to take plenty of time at its meals. The common practice of giving pieces between meals is a very bad one, and should be discouraged.

CHAPTER IX

THE HYGIENE OF INFANTS AND CHILDREN

The hygiene of infants and children—The bath—The clothing—Care of the eyes—Care of the mouth and teeth—Care of the skin—Control of the rectum and bladder—The nervous system—Sleep—Exercise—Airing—The nursery—The nurse—School.

THE first care of the nurse after the child is born is to see that the cord is securely tied. The string used for the purpose should be as thick as ordinary twine, and it should be tested before being applied to see that it is quite strong. A thin string, though it may be strong enough, may cut into the cord and give rise to serious hæmorrhage, and to avoid this danger many make use of a narrow tape. Whatever form of ligature is used, it should be perfectly aseptic, and to attain this end it is immersed for half an hour before being applied in a corrosive solution. The after-treatment of the cord is equally important. It should be dressed each day with every regard to strict antisepsis, nor should these precautions be relaxed until a soundly-healed navel is obtained. By careful attention to these details, such troublesome affections as umbilical polypus and pustular eruptions are prevented, and the danger of pyæmic diseases, or of tetanus neonatorum, is reduced to a minimum. The greatest care should be taken lest any roughness be used in removing the soiled dressing, and especially at the time when the cord is about to separate, for forcible removal of it will be followed by bleeding, which may be—indeed, often is—extremely difficult to arrest. After the ligature of the cord the child should be

wrapped in a flannel sheet which has been made quite warm.

The Bath.—The eyes of the infant should first be attended to, and any mucus or vaginal discharge carefully wiped away by means of soft rags or pledgets of absorbent cotton. The eyelids should be thoroughly cleansed by means of water which has been boiled, and finally the eyes and eyelids are douched with a saturated solution of boric acid. Credé recommends that in every instance a few drops of a 2 per cent. solution of nitrate of silver should be instilled into each lacrymal sac, and certainly, where there is any suspicion of a purulent vaginal discharge, this which is an efficient preventive of ophthalmia neonatorum, should be done. The infant's first bath should be given before a good fire and in a warm room. The water should be neither too hot nor too cold, not warmer than 100° F., and not colder than 98° F. The application of oil in the first instance facilitates the removal of the vernix caseosa, and this is followed by a thorough cleansing with soap and water and a soft flannel cloth. The scalp, the nose, the ears, the folds of the neck, the armpits, the groins, the genital organs, and the buttocks, should all be cleansed with care, the soap being sponged off completely in the bath. The infant is now received into a soft warm towel and rapidly dried, after which the groins, the buttocks, the axillæ, and the folds of the neck, are freely dusted with some such dusting-powder as the Sanitary Rose Powder. The diapers should be soft and absorbent, both of which qualities are attained by using 'Gamgee' tissue. After it is dressed the child is placed in its crib and covered with blankets, and should the feet be cold or the fingers a little blue, a hot-water bottle is placed near, but not in contact with, the body. For the first few months the bath should be given at 98° F., and preferably before the open fire. The addition of salt to the water used is advantageous, one handful to the gallon of water being the proper quantity. The temperature of the water should be gradually lowered, and by the end of the first year, if the child is strong and vigorous, the bath may be ended with a cold douche or sponge of water at a temperature of 65° F. This cold douche should last but half a minute, and be followed by

vigorous friction of the entire body. The bath should be succeeded by a proper amount of reaction, without which it is depressing to the child and may be injurious.

The Clothing.—During the first week after birth a flannel binder is necessary to protect the navel and to keep the dressings in position; after this date binders are better avoided. The infant's clothes should be light, warm, non-irritating to the skin, and loose enough to allow of free expansion of the chest. The chest should be covered with a shirt made of wool or silk, or of half cotton and half silk; it should be high in the neck and have long sleeves. The abdomen should be well protected, and, where there is the least tendency to looseness of the bowels, indigestion, or flatulent distension, an additional safeguard should be provided in the form of a pad of flannel or absorbent cotton-wool. The lower limbs should be well covered and kept warm at all times, especially the feet. The clothes must be loose enough to permit the child to make free use of its legs, this being the only way in which the infant can obtain the exercise necessary for proper development. The fashion of low neck, and short sleeves for children has passed away to a considerable extent, but there are still some who believe in the principle of 'hardening,' and think it right to send their children out with bare legs and sandals. In a variable climate like that of the British Isles, such a practice is fraught with much danger, and certainly many children are injured by such attempts at hardening. On the other hand, too much clothing is equally bad, and by overheating exposes the child to the risks of chilling. The night-clothing of infants and children is equally important. The tendency, undoubtedly, is to overload children with clothes in bed. This makes the child too warm, and causes it to kick off the clothes, whereby it is exposed to chill. For young children a night-dress made of soft flannel, and having a high neck and long sleeves, is very suitable; if the child be of the restless type, and is given to kicking and tossing about, then the night-dress had better be made after the style of a sack. Should the limbs and feet become cold, an extra covering in the shape of flannel stockings may be added.

The shoes worn by the child should be large enough

to allow of free development. The great mistake is making it wear shoes which are too short, whereby the great toe is pushed outwards and pressed against the second toe, with the result that it is driven backwards.

Care of the Eyes.—For the first month after birth the infant's eyes should be protected from bright light. They should be carefully cleansed each day, and for a few days after birth the precaution may be taken of ending up the cleansing of them with a douche of a saturated solution of boric acid.

Care of the Mouth and Teeth.—After the infant has finished nursing, whether the food be taken from the breast or drawn from a feeding-bottle, its mouth should be gently cleansed with a soft rag which has been dipped in a solution of bicarbonate of soda or borax (20 grains to the ounce). The practice of kissing children on the mouth is much too prevalent and indiscriminate. The germs of tuberculosis, syphilis, and other diseases, can readily be transmitted in this way, and the custom should be strictly limited to a very narrow circle.

The Teeth should receive careful attention daily, a point which is too often neglected. Dirty teeth lead to carious teeth, and carious teeth are a constant source of danger, not only on account of the suffering they occasion, but because of the infectious germs which they harbour, and which may be conveyed from them into the stomach or the lymphatic channels. The teeth should be washed with some antiseptic every day, and before going to sleep for the night the operation should be repeated, as during this period particles of food have the best opportunity of becoming decomposed, and thereby injuring the teeth. Carious teeth are an abomination, and should be promptly stopped or extracted.

Care of the Skin.—As the skin acts the part of a great emunctory, it should be kept clean, in order that its important function may be perfectly performed. The daily bath is, therefore, advisable, and a bland, unirritating soap should be used. In some children the skin is much more tender than in others, and for these the bran, or the alkaline, bath may be chosen. In particular, the folds of the neck, the armpits, the groins, and the buttocks should be attended to, whereby intertrigo or eczema is prevented,

affections, it may be added, which are much easier of prevention than cure.

Control of the Rectum and Bladder.—The importance of training young children to regular habits in evacuating the bowels and the bladder is very great. By beginning early to accustom the child to use the chamber at stated times, no difficulty will be experienced, but a great amount of trouble and annoyance will be avoided.

The Nervous System.—For the normal healthy development of the nervous system, quiet, rest, and peaceful surroundings are necessary. The brain grows more during the first two years than in all the rest of life, and during this period the child is easily excited, and its nervous system may be readily shocked. Excitement should be especially prohibited towards evening. The pernicious practice of telling young children ghost stories, or frightening them with the terrors of the bogie-man, and so forth, must be rigidly suppressed, for the impressionable mind of the child seizes readily upon these, and conjures them up for long after.

Sleep.—The sleep of early infancy is quiet and peaceful under normal conditions. During the first few weeks the healthy infant sleeps about twenty hours out of the twenty-four, during the first six months from sixteen to eighteen hours, and at the age of one year fourteen to fifteen hours. When two years old, eleven or twelve hours' sleep are taken at night, and this is supplemented by a nap of an hour or two during the day. At the age of four years the daily nap is given up, and the child sleeps from ten to twelve hours during the night. Regular habits should be taught in the matter of putting children to bed, and, like others, if begun early such habits are easily attained. The child should be accustomed to being put into its crib while still awake, and to go to sleep without being rocked, or given a comforter to suck. A quiet and darkened room, a warm and comfortable bed, dry napkins, and an appetite satisfied, are sufficient to induce sleep in a healthy infant.

Exercise.—An infant obtains exercise by kicking its legs about, by waving its arms, and by crying lustily. To encourage the movements of the arms and legs, the child should not be allowed to lie too long in its crib, but

should be taken up and carried about or dangled in the arms from time to time. It is very seldom that the development of the respiratory muscles suffers from want of that form of exercise which is derived from crying. When old enough to creep or stand, every facility should be afforded children to exercise their muscles, and they may be put upon a large bed, or upon a rug on the floor of a warm room, and allowed to tumble about at will. In older children out-of-door exercise is very necessary, and games suitable to the age should be encouraged. One danger should be guarded against, which is, that the child be not allowed to sit down to cool: this is a very frequent cause of chill and other affections. Gymnastic exercises are very valuable, but they can never take the place of vigorous games in the open air.

Airing.—If the weather is warm and genial, the infant should be taken out for half an hour when it is a fortnight old, and from this age onwards the time may be lengthened so that the child spends a considerable portion of the day in the open air. Even on cold days it may be taken out, care being exercised that it is kept warm, especially the feet. In so variable a climate as ours there is much to be said in favour of accustoming a child to rapid changes of temperature, and during wet weather the windows of the nursery may be thrown open every now and then, and the child walked about in the incoming air. Infants and young children should not be taken out during the prevalence of high winds, especially when they come from the east or the north; they are better kept indoors during the subsidence of a frost, or when snow is melting.

The Nursery.—The sunniest and best-ventilated room in the house should be the one chosen for the nursery, because it is here that the child will spend at least four-fifths of its time during the first year, and two-thirds of its time for the second and third years. Sunlight is indispensable, and therefore the room should have a southern aspect. During the time the child is in the room free ventilation should be secured by means of ventilators, while at the same time draughts are avoided. While the child is absent from the room the windows should be widely opened for the purpose of thorough airing. In very cold weather sufficient ventilation will be secured by

means of an open fire ; at other times the window should be lowered a little from the top. The air of the nursery should be kept as pure as possible at all times, and such sources of contamination as soiled chambers, or evacuations, must on no account be allowed to remain in the room ; nor should the washing and drying of napkins in the apartment be permitted. No food should be allowed to stand in the room, and as soon as the child is fed the utensils should be removed. The gas should not be allowed to burn at night, its place being supplied by a wax nightlight. Where necessary, the room may be heated at night by means of an open fire or an oil-stove, but under no circumstances should a gas-stove be allowed. The temperature of the nursery should be 65° F. during the day, and this is a point of some importance, for, as a rule, nurseries are overheated. During the night for the first few months this heat should be maintained, but after the first year it may be allowed to fall to 60° F., or even 50° F. The furniture should be simple, and all heavy draperies dispensed with. A large warm rug in the centre of the floor is to be preferred to a carpet, as it can be easily taken up and shaken at frequent intervals. The infant should sleep in a cot, whereby the danger of overlying is avoided. Older children should have iron beds which can be readily cleansed by wiping. The mattress should be of hair and quite firm, the pillow should be small and be filled with feathers for the winter, and with hair for the summer months.

The Nurse.—The old idea that the nurse should be an elderly woman, who would by virtue of her length of years possess a corresponding wealth of experience in nursing, is quite exploded. Nowadays the nurse is a young person, and generally of comely appearance, who is not insensible to the attractions of a neat costume or a smart hat. Nor are these disadvantages, for one likes to see the nurse turn out smart, and clean, and tidy, and the chances are all in favour of the child being clean and tidy also. She should be willing to yield an implicit obedience to all orders which she receives from her mistress, and she ought to possess an abundance of good nature, which will enable her to understand the varying moods of the infant. She should be healthy in all respects, and free

from tuberculous or syphilitic taint, and from catarrhal affections of the nose and throat. I have been asked more than once by mothers choosing nurses if a small degree of squint constituted an insuperable objection to engaging them. I advised against employing all such, on the ground that, as young children are notorious imitators, it was possible for a similar condition to become acquired.

School.—I have very little to say on this subject. I think the tendency at present is to send children to school at too early an age. Remembering that the brain of the child is growing rapidly, and as a consequence is very easily excited, I believe the stimulus derived from his surroundings and his indoor life is quite sufficient for some years. Many seem to forget that the child is learning every day—it may not be how to spell and how to write, but the brain is being continually exercised in various ways. For instance, the child sees various animals passing the window, and is shown the difference between them until it becomes able at once to recognise them for itself. Or, again, it is shown picture-books, from which the brain is taught to discriminate between trains, and carts, and houses, and so forth. Is this not learning, and is it not sufficient for the time being? I believe it is, and until the age of six years I do not think the excitement of going to school and entering into competition with other children is necessary or advisable.

So able an authority as Dr. Rotch writes: 'No time is lost, in my opinion, in sending children to school at a somewhat later age than is usually supposed to be necessary. I am continually having to take little children out of school who are fretful and have loss of appetite. Neither parents nor teacher seem to appreciate that the little, actively-growing brain is overtaxed by too great stimulation, and is protesting against such treatment by these general symptoms. Many a child is being dosed with tonics who merely needs rest from school.' When attending school, the child should have ample time for recreation out-of-doors, and his lessons should not be such as to occupy too long a time in preparing. Parents

should see to it that the child's mental capacity is not overtaxed, and, above all, no forcing should be countenanced. The child should enjoy going to school, and should be able to prepare his lessons for the next day without these giving him worry; otherwise there is something wrong, and to persist will only make matters worse, and may in the end lead to disastrous results.

APPENDIX A

FOOD PREPARATIONS SUITABLE FOR INFANTS AND YOUNG CHILDREN

Albumin-Water.—Take the white of a fresh egg and whip it up in a mug until it is quite free from stringiness. Add to it 6 ounces of tepid water—it must not be hot, else the albumin will become coagulated—and a good pinch of salt. This may be given to young children who digest the proteids of milk badly, and it is an excellent food in acute gastric attacks, being very bland and unirritating. I have given it frequently in typhoid fever, and with most satisfactory results.

Arrowroot-Water.—One teaspoonful of arrowroot is made into a paste by rubbing it up with a tablespoonful of cold water. A pint of boiling water is added, and the mixture is boiled for five minutes. It is a useful diluent for milk in summer diarrhœa.

Barley-Water. Put two teaspoonfuls of washed pearl barley with 1 pint of cold water into a saucepan, and simmer slowly down to two-thirds. Strain. It should not be allowed to boil. Barley-water does not keep fresh beyond a few hours. It should therefore be made fresh twice a day. The mistakes of making barley-water too strong and keeping it too long are very common ones, especially when it is used to dilute cow's milk for a young infant. For such one teaspoonful to a pint is sufficient.

Barley Jelly.—Two heaping tablespoonfuls of washed pearl barley are added to 1½ pints of water, and slowly boiled down to 1 pint. The barley is strained out and the fluid allowed to settle, when a jelly forms.

Two teaspoonfuls of this jelly may be added to the bottle for a child of eight or nine months of age.

Beef Juice, also called Raw Meat Juice.—Dr. Cheadle gives the following directions for preparing this: Raw meat juice should be prepared by mincing finely the best rump steak, and adding an equal quantity of pure cold water—*e.g.*, one tablespoonful of mincemeat to one tablespoonful of water. This should be well stirred together, and allowed to soak for half an hour cold. The juice should then be forcibly expressed through muslin by twisting it. By this means the cysticercus is excluded. This is the best material for supplying proteid to the food of children, one teaspoonful of which may be added to the bottle without changing the taste of the mixture.

Bread Jelly.—Take a thick slice of bread (4 ounces), two or three days old, place it in a basin of cold water, and allow it to soak for six or eight hours. At the end of this time squeeze all the water out of it, place it in 1 pint of fresh water, and gently boil for an hour and a half. The thick gruel thus made is strained, or rubbed through a fine hair sieve and allowed to grow cold, when it forms a fine, smooth, jelly-like mass. It does not keep long, and should therefore be made fresh each day at least. It should be given with milk in the proportion of one tablespoonful to 8 ounces. If made with plain water the mixture is very deficient in proteid and fat.

Caraway-Water.—Put 1 ounce of caraway seeds in a small muslin bag and boil it in 1 pint of water until reduced to ½ pint. One teaspoonful may be given alone or added to the bottle for the relief of flatulence or colic.

Cheadle's Food.—Mix four parts of bread jelly made with water only, three parts of raw meat juice, ½ pint of cream, and one-fifth part of sugar. One tablespoonful of the food in 6 ounces of water makes a very nutritious meal for a child of eight or nine months old.

Cream and Whey Mixture.—Mix together 1 ounce of cream, 2 ounces of whey, 2 ounces of hot water, and one teaspoonful of sugar of milk or cane-sugar. This forms a good combination for young infants who cannot digest cow's milk well.

Egg-Albumin.—See Albumin-Water.

Egg and Barley Water.—Whip up finely the white of

one egg and add to it 6 ounces of thin barley-water and one teaspoonful of white sugar. Strain the whole through muslin and add one tablespoonful of good cream. A useful mixture for a child six months old. The mixture is heated, but must not be boiled, else the albumin will become coagulated.

Egg-Nog.—Beat up a fresh egg in a tumbler with two teaspoonfuls of white sugar and add one dessertspoonful of good brandy. Scald ½ pint of sound whole milk, and when it is cold add it to the brandy and egg mixture and stir all together. A nutritious drink and useful stimulant for children suffering from acute disease.

Gelatin.—Take a piece of gelatin 2 inches square and allow it to soak for three hours in cold water. At the end of this time place it in ½ pint of boiling water and dissolve it. On cooling it forms a jelly. One teaspoonful added to each bottle of milk food prevents, to some extent, the casein of cow's milk forming dense masses of curd.

Oatmeal-Water.—Stir one tablespoonful of fine oatmeal into 1 pint of boiling water ; cover, and allow it to simmer for one hour, with occasional stirring. Keep the quantity up to 1 pint by replacing the water as it evaporates. Strain through muslin. May be used as a diluent instead of barley-water when the child has a tendency to constipation, or when the motions become lumpy.

Rice-Water.—A large tablespoonful of rice is added to 1 quart of water and kept at a tepid heat for two hours. At the end of this time boil slowly for one hour, and strain. In cases of looseness of the bowels it is a useful diluent of milk.

Toast-Water.—Pour 1 pint of boiling water on to three well-toasted slices of white bread. Let it stand until cool and strain. This is a useful drink in fevers and in gastric attacks with vomiting.

Veal-Tea.—One pound of veal, free from fat, is cut into small pieces and put in 1½ pints of cold water. This is allowed to simmer slowly on the fire for three hours, when it is strained and skimmed. Serve hot.

Whey.—To 1 pint of fresh lukewarm cow's milk is added two teaspoonfuls of rennet. It is stirred for a few seconds, and then allowed to stand until firmly coagulated. The curd is then finely broken up with a fork, and the

whey or watery portion is strained off through muslin. If it is desired to have as little fat in it as possible, the whey is made with milk the fat of which has been removed by a separator, and it should be strained through fine muslin and absorbent cotton without using any pressure to the curd. On the other hand, if it is desired to retain as much of the fat as possible, whole milk should be used, the straining should be through coarse muslin, and the curd squeezed firmly. By this method a considerable amount of fat and finely divided casein pass through, and the fluid is thereby rendered much more nutritious. It is not desirable to boil whey, as boiling precipitates the lactalbumin.

Wine Whey.—Add an ounce or two of sherry to ½ pint of whole milk while boiling. The curd is well broken up and squeezed through muslin. Dr. Ashby substitutes brandy for the wine, and thinks it agrees better.

APPENDIX B

RULES FOR THE MANAGEMENT OF INFANTS AND YOUNG CHILDREN

A PAMPHLET on the following lines was printed some few years ago by the medical staff of the Belfast Hospital for Sick Children A copy of it is handed to each mother as she leaves the out-patient department. I have amplified it in some respects.

I. General Directions.

Keep the child warm. The clothing should be light, warm (*i.e.*, woollen or flannel), and loose. The binder, if used, must not be tight. Air the clothes every day and wash them frequently. Cover the arms with long sleeves, and the legs with drawers and long stockings. Wash the child all over with soap and warm water once a day. Let the child have an abundance of fresh air, and take it out whenever the weather is fine. Open the windows and air the room thoroughly at least twice daily.

II. Breast Feeding.

If the mother has plenty of breast milk, the child should get no other food of any kind whatever until it is eight or nine months old. For the first month give the infant the breast every two hours during the day, and once during the night. As the child gets older gradually increase the intervals, so that at the end of the third month it is suckled every three hours during the day, and once in the night. Too frequent suckling, and

especially giving the child the breast whenever it cries, is very bad for both the mother and the child, and may result in serious disease. If the mother has not enough milk, she may give the child a little cow's milk in addition to her own, but modified as directed in Rule III.

III. Bottle Feeding.

If the infant must be brought up by hand, it should be fed from a bottle on cow's milk mixed with water (which has been previously boiled) or with barley-water. Be careful to make the barley-water as follows: Two teaspoonfuls of washed pearl-barley are put in a pint of cold water and allowed to simmer down to two-thirds of a pint, when it is strained through muslin. A fresh quantity must be made at least twice daily, because it does not keep fresh long. The milk must be 'scalded'—that is, boiled for a few minutes before use and this direction should never be forgotten in the summer months. The milk which the child leaves must on no account be used again, but a fresh supply should be prepared for each feeding.

The best kind of bottle has no tubing, as a tube cannot be kept clean. The bottle must be scalded each time after it is used, the teat turned inside out and thoroughly washed, and both bottle and teat kept immersed in clean water, to which one teaspoonful of baking soda has been added, until wanted again. The following table shows how often an infant should be fed, how much it should get at a time, and the strength of the milk used:

Age.	How often in Day.	How often in Night.	How much at a Time.	Strength of Milk.
Birth to four weeks	Every 2 hours	Once	4 tablespoonfuls	One-third
Four to eight weeks	Every 2½ hours	Once	6 tablespoonfuls	One-half
Three to six months	Every 3 hours	Once	8-12 tablespoonfuls	Two-thirds

Add to each feed two teaspoonfuls of cream and a lump of sugar.

IV. Diet for a Child from Eight Months to One Year.

If at eight months the child be strong and healthy, it may have one or two meals a day of well-boiled porridge or gruel, or of oat flour or entire wheaten flour, prepared with water and milk. In addition, it must have three meals a day of breast milk, or of pure cow's milk (about twelve tablespoonfuls at a time). At ten or twelve months the child may get a little broth or soup, or gravy and bread-crumbs, or the yolk of an egg, once a day.

V. Weaning.

The child should be weaned gradually at eight to ten months of age by substituting one bottle feed for one breast feed, and so on until the breast is given up altogether.

VI. Diet for a Child from Twelve Months to Eighteen Months.

First Meal, 7 a.m.—Bread and milk, or oatmeal porridge, with plenty of whole cow's milk.

Second Meal, 11 a.m.—Pure milk—a good cupful—and a biscuit.

Third Meal, 1.30 p.m. Bread-crumbs and gravy, or meat broth (made with rice or barley, and without vegetables), or a lightly boiled egg and bread-and-butter. Some milk pudding, or suchlike, may be given as a second course.

Fourth Meal, 5.30 p.m.—Bread-and-butter, and milk to drink.

Fifth Meal, 7 p.m.—A drink of good, whole, sweet milk.

At twelve months of age a child requires about 2 pints of sweet milk each day.

VII. Diet for a Child at Eighteen Months.

Give the child a little underdone meat every day, scraped or pounded into a soft pulp, or finely minced and mixed with a little fat; or some mashed potato with

gravy. Milk should, however, still continue to be the main food.

VIII. What to Avoid.

Never give a child food simply because it cries. Never give 'pieces' or biscuits between meals, or a share of 'what is going' amongst the other members of the family. Train the child to regularity in taking its meals, in going to bed, and in attending to the calls of nature. Never give a child soothing syrups, worm powders, sleeping-draughts, or spirits, except under the advice of a doctor, and beware of unripe or overripe fruit, especially during the hot months of the year. Do not give tea or coffee to a child under two years of age. Oatmeal porridge and good fresh cow's milk make strong, healthy children; tea and white bread tend to make them weak and delicate.

APPENDIX C

THE STORAGE OF MILK IN THE HOME

It has already been stated that milk as it comes from the udder of the cow is, for all practical purposes, sterile—that is, it is free from noxious germs ; and if such a desirable condition is to continue, the most rigid antiseptic precautions must be used. The udder and teats, and the hands of the milker, must be thoroughly cleansed with soap and water, and after this washing they should be well sponged with an antiseptic solution. The milk-pails into which the milk is received must be perfectly clean, and all water used in rinsing the milk-cans must be previously sterilized. The shed in which the milking is carried out should be quite clean, and as free as possible from dust. Immediately the milking is over, the milk should be carefully strained through sterile cloths, or eight thicknesses of sterilized gauze, into fresh, clean pails and placed in a refrigerator until required. It is possible to obtain a decently clean milk-supply by following out conscientiously the above directions—indeed, Dr. Rotch has proved this in his milk laboratories—but that they are followed to even a small extent by the purveyors of milk in the large centres of population seems at present very doubtful.

I need not draw a picture of the way in which the milking and the collecting of milk is conducted in many of the dairies ; suffice it to say that by the time it reaches the consumer it is generally far from being sterile. Seeing, then, that we are apparently a long way off the adoption of the milk laboratory system, is there anything which can be done by the consumer after the milk reaches

his house, whereby the growth of bacteria may be restrained or prevented? It has been shown that the epidemic outbreaks of diarrhœa in young children, which occur regularly every summer, are, to a very large extent, caused by a contaminated milk-supply. The following directions are submitted in the hope that they may in some measure control these epidemics.

1. **Immediately the milk is received put it in a saucepan, and raise it rapidly to the boiling-point.** This is known amongst the poor as 'scalding the milk.' Pour it out into a jug which has been recently scalded, and cover the mouth of the jug with a cloth which has been rendered sterile, either by immersion in an antiseptic solution, or by boiling. Place the jug containing the milk in a refrigerator, or on ice, or surround it with pounded ice and salt. Even the very poor can place the jug in cold water. The heating to boiling-point of the milk kills the germs in it, and the subsequent keeping of the milk at a low temperature greatly retards bacterial growth.

2. **Endeavour to get your milk-supply within two hours of the time at which it is milked, or in a shorter time if possible.** Those who can accomplish this while living in large cities may consider themselves fortunate, for the milk is often twelve hours old before it reaches the houses of the poor, by which time it is swarming with micro-organisms; hence the urgent necessity there exists for boiling it under such conditions immediately it is received.

3. **Never allow the milk to stand in the kitchen, and above all, on no consideration must it be kept in a sick-room.** Micro-organisms grow very well and very rapidly in milk, but especially so if it is allowed to stand in a warm place.

I feel sure, if these rules were strictly carried out and persistently adhered to, that the scourge of summer diarrhœa, with its appalling death-rate, would be greatly lessened, if not entirely stamped out.

INDEX

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